THE

Practical Teacher

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'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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Honours Hygiene.

BY

ARTHUR NEWSHOLME, M.D., D.P.H. UNIV. LOND.,

Medical Officer of Health for Brighton.

INLETS AND OUTLETS.

If it be assumed that a man measures 6 feet by 1½ feet, he presents a superficial area of 9 square feet. If we multiply this area by the average velocity of the air in the open (*i.e.*, 10 feet per second or about 7 miles per hour), we find that in an hour 324,000 cubic feet of air flow over one person in the open air. It is evident, therefore, that if 3,000 cubic feet be introduced each hour into a room for each person in it, the allowance is only about $\frac{1}{100}$ of that enjoyed in the open air.

Any velocity of air between 40 and 70 miles an hour is called a gale, over this a storm.

Air moving at the rate of 2 miles an hour (*i.e.*, about 2·9 feet per second) is just perceptible. Air moving at the rate of 2½ miles per hour is perceived as a slight draught by all. The greater the difference between the external and internal air, the more rapid are the incoming currents of air.

It is evident that having given the average velocity of the wind, the size of a room, and the number of persons occupying it, the size of inlet opening required can easily be calculated.

Example 12.—Find the size of inlet for air in a room occupied by one person, the air moving at the average velocity of 5 feet per second, assuming that 3,000 cubic feet of air is to be supplied per hour.

Let x = size of inlet,
Then $x \times 60 \times 60 \times 5 = 3{,}000$,
Therefore $x = \frac{3000}{18000} = \frac{1}{6}$ square foot.
$= \underline{24 \text{ square inches.}}$

Example 13.—Given that the air moves at a velocity of 10 feet per second, and that the area of the inlet aperture into a room is 12 square inches, find how much air enters the room in an hour.

Let y = amount of air,
Then $10 \times 60 \times 60 \times \frac{12}{144} = y$,
Therefore $y = \underline{3{,}000 \text{ cubic feet of air.}}$

Calculations as to supply of air in a room founded on the *average* velocity of air-currents, are, however, much less trustworthy than when the velocity is determined, as previously explained, by means of Montgolfier's formula, or, better still, by an anemometer.

Practically it is found that a change of the air in an occupied room three or four times in an hour is all that can be borne under ordinary circumstances in this country. The only exception to this statement is when the incoming air is warmed, thus preventing the perception of draughts.

The Commissioners on Improving the Sanitary Condition of Barracks and Hospitals, in their report (1861) recommended for *inlets*, one square inch for every 60 cubic feet in the contents of the room; or one square inch for every 120 cubic feet in the contents, if warm air is admitted round the fire-grate. For *outlet* shafts on lower floor one square inch to every 60 cubic feet, slightly increasing for the higher stories.

AMOUNT OF AIR TO BE SUPPLIED.

We have already given 6 parts of carbonic acid in 10,000 of air as representing the maximum allowable impurity of the atmosphere of a room, the external air containing 4 parts of carbonic acid in 10,000 of air.

We know that each individual, on an average, eliminates ·6 cubic feet of carbonic acid per hour. Dr. A. Smith put the average hourly exhalation of carbonic acid as low as ·4 cubic feet; while Pettenkofer states it as ·7 cubic feet, and Liebig as ·79 cubic feet. The amount ·6 cubic feet may be taken as an average. The quantity of air required per hour has been calculated by various methods, as shown below.

BRITISH MUSEUM

(1.) The amount of air taken in with each inspiration is about 30 cubic inches. As there are, on an average, 17 respirations per minute, it follows that 17·7 cubic feet of impure air are expired from the lungs in the course of an hour.

Now expired air contains 4·38 per cent. of carbonic acid as compared with ·04 per cent. in the case of pure inspired air, *i.e.*, about 400 times as much. We have stated above that this must be so freely diluted with external air, that the proportion of carbonic acid does not exceed ·06 per cent. But the external air contains already ·04 per cent. of carbonic acid. It follows, therefore, that the 17·7 cubic feet of expired air, containing 4·38 per cent. of carbonic acid, must have an additional quantity of air added which will bring down the carbonic acid to ·02 per cent. more than in the outside air. Thus,

$$\cdot02 : 4\cdot38 :: 17\cdot7 : x$$

Therefore $x = 3{,}876$ cubic feet of air required to sufficiently dilute it.

(2.) If we assume the hourly production of carbonic acid per person to be ·6 cubic feet, and the allowable limit of carbonic acid as ·6 per 1,000 of air (*i.e.*, ·2 per 1,000 more than in the external air) it is evident the expired air must be diluted by $\frac{6}{2} \times 1{,}000 = 3{,}000$ cubic feet of fresh air.

(3.) It has been found that the smallest amount of food capable of maintaining life contains 18 or 19 grains of carbon for each pound weight of the body. This, when oxidised, is equivalent to 150 cubic inches of carbonic acid: so that a man of 126 pounds (9 stone) weight produces daily 11 cubic feet of carbonic acid. This is the amount when at absolute rest. If we allow half as much again for a fair average, then a man weighing 9 stone eliminates 16 to 17 cubic feet of carbonic acid *per diem*. Pettenkofer found by actual experiment that, with gentle exercise during the day and rest at night, 232 cubic inches of carbonic acid were given off per pound weight, *i.e.*, about 17 cubic feet in 24 hours for a man weighing 9 stone. This is equal to an elimination of ·7 cubic feet of carbonic acid per hour.

Now, inasmuch as the air of a room must not contain more carbonic acid than ·2 per 1,000 in excess of the external air, it is evident that the ·7 cubic feet expired per hour must be diluted with $\frac{7}{2} \times 1{,}000 = 3{,}500$ cubic feet of fresh air.

(4.) The amount of air required per head per hour may be calculated finally from the point of view of the degree of moisture present in the air.

In this climate the most pleasant degree of humidity is generally stated as being about 75 per cent. of the amount required for saturation of the air. The capacity of air for moisture increases enormously with rise of temperature; thus an amount of moisture that would saturate the air at 50° F. would give a relative humidity of only 71 per cent. at 60° F. Air absolutely saturated with moisture at 32° F. holds watery vapour equal to $\frac{1}{168}$ of its weight; at 59° equal to $\frac{1}{82}$, at 86° equal to $\frac{1}{41}$, at 113° equal to $\frac{1}{20}$, and at 140° equal to $\frac{1}{10}$. Thus the temperature advances in arithmetical progression, the retentive power for moisture in geometrical progression.

Every man gives off from lungs and skin each hour, enough vapour to raise the humidity of 500 cubic feet of air, at 60° F., from 70 per cent. to saturation, and of 1,500 cubic feet at 60°, to 82 per cent. In order to reduce this amount to 73 per cent., 3,000 cubic feet of air saturated at 50° F. must be supplied, or 2,000 at 98 per cent. But humidity is produced from the combustion of lights and from the evaporation of any fluids in the room; hence, with an initial air-space of say 1,000 cubic feet, it is found necessary to supply 3,000 cubic feet of air per hour in order to keep the air of a room in its proper condition as regards humidity (De Chaumont).

We may take 3,000 cubic feet of air as the average amount of air required hourly by each individual, and inasmuch as the air of a room cannot be changed oftener than three times in an hour without producing an unpleasant draught, it follows that at least 1,000 cubic feet of space must be allowed per person.

This may be compared with the amount actually supplied under various circumstances.

In the British Army for each soldier—

In permanent barracks	...	600 cubic ft.
In wooden huts	... ...	400 „
In hospital wards at home	...	1,200 „
„ „ in the tropics,		1,500 „
In wooden hospitals at home,		600 „
In general hospitals	...	1,000-1,500 „
In fever hospitals	...	2,000-3,000 „
In workhouse hospitals,		850-1,200 „
In common lodging houses	...	300 „
Do., if occupied night and day,		350 „
In workhouses	... ...	300 „

In Schools—

London School Board requires per scholar	...	130 „
English Educational Department per scholar	...	80 „

Floor-space has an important bearing on ventilation. In calculating the available cubic space of a room, the height over twelve feet should be disregarded. Thus, if 500 cubic feet is allowed for each individual, the floor-space should be 42 square feet. In barracks, soldiers are allowed 50 square feet of floor-space.

For schools, the Educational Department requires 8 square feet of floor-space for each scholar. If we assume that 1,500 cubic feet of air are required hourly for each scholar, then an allowance of 80 cubic feet of air-space involves that the air must be replenished 19 times each hour. So frequent an exchange of air is impossible, unless warmed air is introduced, or mechanical means of ventilation are employed, and it follows that the air in most schools is in a very vitiated condition.

In the Government regulations for workhouses it is stated that there must not be more than two rows of beds, and that the height of rooms above 12 feet must not be reckoned. This gives a minimum floor-space of 25 square feet per occupant.

In hospitals, the question of floor-space is extremely important, as it regulates the distance between the sick inmates and the convenience of nursing. Assuming each bed to be 3 feet wide and $6\frac{1}{2}$ feet long, the distance between any two beds should be at least 5 feet. This makes the wall-space for each bed 8 feet long. If the width of the ward is 25 feet, then there is a passage 11 feet wide between the two rows of beds for the whole length of the ward. The superficial space available for each bed is $\frac{25}{2} \times 8 = 120$ square feet. If the height of the ward be reckoned as 12 feet, then the available cubic space is 1440 cubic feet.

Usually a wall-space of $7\frac{1}{2}$ feet is allowed for each bed, which, with a ward 25 feet wide, would allow about 94 square feet of space for each bed. At St. Thomas's Hospital the allowance is 112 square feet. In Fever Hospitals the floor-space should be 150 to 300 square feet.

MEANS OF ASCERTAINING CUBIC SPACE.

Circumference of a circle = Diameter (D) × 3·1416.

Area of circle = $D^2 \times .7854$.

Area of square = square of one of its sides.

Area of rectangle = product of two adjacent sides.

Area of triangle = base × $\frac{1}{2}$ height, or height × $\frac{1}{2}$ base.

Area of ellipse = product of the two diameters × ·7854.

Circumference of ellipse = half the sum of the two diameters × 3·1416.

Area of any polygon found by dividing into triangles, and taking the sum of their areas.

Cubic capacity of a cube found by multiplying the three dimensions together.

Cubic capacity of a cylinder = area of base × height.

Cubic capacity of a cone or pyramid = area of base × $\frac{1}{3}$ height.

Cubic capacity of a dome = area of base (circle) × $\frac{2}{3}$ height.

Cubic capacity of a sphere = $D^3 \times .5236$.

Area of segment of a circle found by adding to $\frac{2}{3}$ of product of chord and height, the cube of the height divided by twice the chord.

$$(Ch \times H \times \tfrac{4}{5}) + \frac{H^3}{2\,Ch}$$

Example 14.—Give the dimensions of a circular ward for 12 patients, each to have 1,750 cubic feet of available air-space.

Capacity of ward = 1,750 × 12 = 21,000 cubic feet.

If we allow 120 square feet floor-space for each patient, then the total floor space will be 1,440 square feet. Consequently the height of the ward = $\frac{21000}{1440}$ = 14·75 feet.

Area of circle = $D^2 \times .7854$

$\frac{1440}{.7854} = D^2$

Therefore D = 43·2 feet.

Circumference of circle = D × 3·1416
= 43·2 × 3·1416
= 135·7 feet.

The dimensions of the circular ward required are therefore a height of 14·75 feet, diameter of 43·2 feet and circumference of 135·7 feet.

Example 15.—Find the cubic capacity of a circular hospital ward 28 feet in diameter, 10 feet high, and with a dome-shaped roof 5 feet high.

Area of floor space = $D^2 \times .7854$
= 614·8 square feet.

Cubic capacity of the cylinder below the dome is
614·8 × 10 = 6148 cubic feet.

Cubic capacity of the dome
= 614·8 × $\frac{2}{3}$ × 5 = 2049·3 cubic feet.

Total cubic capacity of the ward = 8197·3 cubic ft.

In practical measurements of rooms deductions must be made from the cubic space for the furniture contained in it and for its inmates. About 10 cubic feet ought to be allowed for each bed and bedding, and $2\frac{1}{2}$ to 4 cubic feet for each individual. Projecting surfaces must be allowed for by subtraction, and recesses by addition.

Example 16.—A circular ward with a diameter of 36 feet has a dome-shaped roof, the height of whose centre is 18 feet. The height to the dome is 12 feet. Find the floor-space and total cubic contents. How many patients ought the ward to accommodate?

Area of floor-space = $(36)^2 \times .7854$
= 1017·8784 square feet.

Cubic capacity of cylinder below dome
= 1017·87 × 12 = 12214·5 cubic feet.

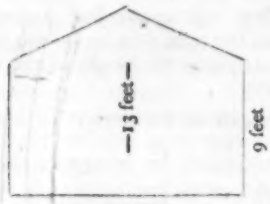
Cubic capacity of dome
= 1017·87 × $\frac{2}{3}$ × 6 = 4071·48 cubic feet.

Total cubic capacity of the ward
= 16285·98 cubic feet.

Assuming that 1,500 cubic feet are required for each patient, then the ward is large enough for *10 patients*. It is well to test this conclusion by calculating whether sufficient floor-space has been allowed for each patient. The floor-space has been found to be about 1,018 square feet, which would give 100 feet for each of 10 patients and more than the minimum standard previously stated.

Example 17.—What number of people should be allowed to sleep in a dormitory 40 ft. long, of which the accompanying sketch is a section?

(Sanitary Institute, Examination for Inspectors of Nuisances.)



The cubic capacity of the quadrilateral space below the roof = 16 × 9 × 40 = 5,760 cubic feet.

Area of floor = Area of base of roof
= 40 × 16 = 640 square feet.

Cubic capacity of roof
= 640 ⅓ (13 − 9)
= 853·3 cubic feet.

Total cubic capacity of dormitory = 6613·3 cubic ft.

If we take the low standard of Common Lodging Houses and allow 350 cubic feet of space for each inmate, then *18 persons* may be allowed to sleep in the dormitory.

Example 18.—How is cubic space measured? What is its relation to ventilation? How much space would a man occupy supposing him to weigh 175 lbs.? How much is usually allowed for a man with his clothes, bed, and bedding?

(*Cambridge University Examination*, 1887.)

Cubic space is measured differently according to the shape of the building (*vide antea*).

We have previously shown that the cubic space of a room is theoretically of less importance than the capacity for frequent interchanges of air. Even the largest room can only supply air for a limited period, unless fresh air is admitted. Practically, however, a large room is very advantageous, as it enables the interchanges of air to occur without serious inconvenience from draughts.

The space occupied by a man is stated by Parkes to be from 2½ to 4 cubic feet (say 3 for the average). He gives the following rule: The weight of a man in stones divided by 4 gives the cubic feet he occupies. Thus a man weighing 12 stones occupies 3 cubic feet.

About 10 additional cubic feet must be allowed for clothing, bedding, and bed for each person.

A man weighing 175 lbs. would, according to the preceding rule, occupy 3⅛ cubic feet of space.

Example 19.—What size of inlet and outlet aperture should be allowed per head? How large should each individual inlet be made? If an inlet aperture 100 square inches in area is divided into four, with apertures of 25 square inches each, what is the loss by friction?

A size of 24 square inches per head for inlet and the same for outlet meets common conditions.

It is desirable to make each individual inlet not larger than 48 to 60 square inches in area, *i.e.*, large enough for two or three men; and each outlet not larger than one square foot, or enough for six men (Parkes). This ensures more uniform diffusion of the air throughout a room. On the other hand the loss by friction is greatly increased by having a number of small openings instead of one large opening. This loss is inversely to the square roots of the respective areas. Thus the square root of 100 is 10, the sum of the square roots of the four apertures of 25 square inches each is 20. The loss by friction is double in the second case what it was in the undivided opening. It is evident, therefore, that in order to get as much air through the four openings as through the original large opening, each must be equal in size to half the original opening.

Example 20.—Why is ventilation more difficult in upper rooms of large houses and in single-storied houses than in the lower stories of large houses?

(See Newsholme's *Hygiene*, p. 198.)

Cold external air being heavier than the internal warm air presses downwards to the lowest point, and pushes up the warmer air. If there were a vacuum in the room, air would rush into it with a velocity which as seen before is represented by the formula

$$v = \sqrt{2gs}$$

Where $g = 32$, $s =$ height of column of air, which we may take as roughly 5 miles.

From this formula we obtain $v = 1306$ feet per sec.

It is evident that in such a case the velocity of entry of air into a vacuum on the ground floor would be greater than into a vacuum on any of the higher stories, owing to the greater velocity acquired through the increased action of gravity.

And the same increased facility of entry of air into lower rooms must hold good under ordinary circumstances, inasmuch as by Montgolfier's formula (which is founded on the fundamental formula $v = \sqrt{2gs}$)

$$v = \sqrt{\frac{2gh\,(t - t^1)}{491}}$$

$h =$ distance between top of chimney and floor of room in question, and thus the velocity with which air enters is governed by the difference between the internal and external temperature, and the height from which the cold air descends in order to take the place of the air which has escaped.

(To be continued.)

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Practical Kindergarten Lessons for English Elementary Schools.

BY MRS. MORTIMER.

Lecturer at the Home and Colonial Training College.

XV.

GIFT XIII.

EXAMPLES OF LESSONS.—PAPER-CUTTING AND MOUNTING.

The material for this occupation consists of one small square of paper (about 4 inches) to be cut, another larger square about 8 inches, on which the pieces are mounted, two pieces of blotting paper, gum and gum brush and scissors.

As in the previous occupations, the material for this one must be talked about. The children will then proceed to fold the small square into an eight-folded right angled triangle, which is the first Fundamental Form.

The square is folded thus:—

1. Fold the square diagonally, and two right angled triangles lying upon one another are produced.

2. Hold this double triangle by its base, fold the right acute angle on to the left acute angle, and a smaller right angled triangle is produced; now it is fourfold.

3. Hold this triangle by its base and again fold the right acute angle on to the left. N.B. — This triangle has one side consisting of two edges and the other of one. In folding the right acute angle on to the left, only one of these must be folded upwards and the other downwards; this is done in order to make all the triangles as nearly as possible equal in size.

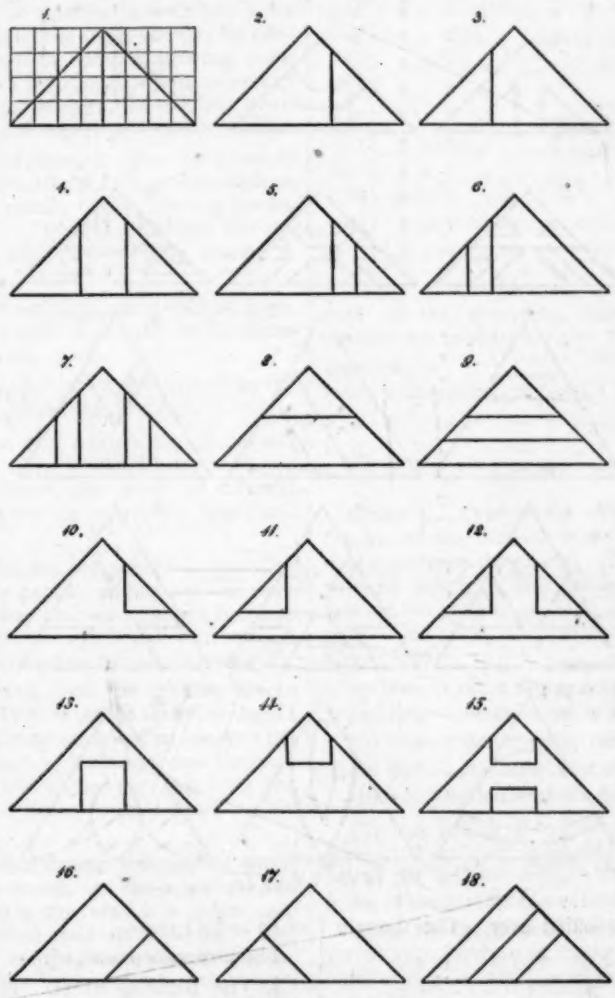


PLATE XXXVI.

Each child has now an eight-folded right angled triangle, and this is the form which he is to cut according to certain rules.

The children should either make creases or mark with lead pencil on the triangle where they are to cut. The entirely open side of this triangle should always be held towards the left.

The simplest cut is along a line drawn from the apex to the centre of the base. When the children have drawn this line they should cut through it, the pieces obtained should be examined: four small triangles and one square arranged on the large square of paper, and when the arrangement is approved of by the teacher, the pieces should be mounted. To help the children mount their pieces accurately, the large squares should have the diagonals and diameters marked.

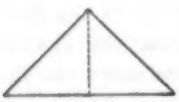
In the early lessons it would be well for the teacher to have a large pattern mounted which she could fix on to the blackboard for the children to see and imitate, it would be well also for the teacher to draw a triangle on the blackboard and show on it where she wants the children to mark theirs.

The two squares must be of different colours in order that the pattern may be clearly seen. The children cut first through perpendicular lines, then horizontal, then oblique, and finally curved ones, as will be shown in the patterns given.

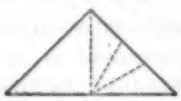
The second Fundamental Form, which is not given until the children are well acquainted with the first, consists of a six-folded equilateral triangle. It is obtained from the square in the following way:—

1. Fold the square diagonally and a right angled triangle is produced.

2. Hold this triangle by its base and fold the right acute angle on to the left; unfold this and there is the right angled triangle with a perpendicular line from the apex to the base, thus—



The right angle that this line makes with the base is to be divided into three, thus—



When the angle is trisected, fold two thirds over. It will then be found that the part of the triangle unfolded is two thirds; this also must be folded over. The triangle now appears thus—

The projecting ends (from *a* to *b*) must be cut off, when it will be found that a six-folded equilateral triangle is produced. The entirely open side is the base.

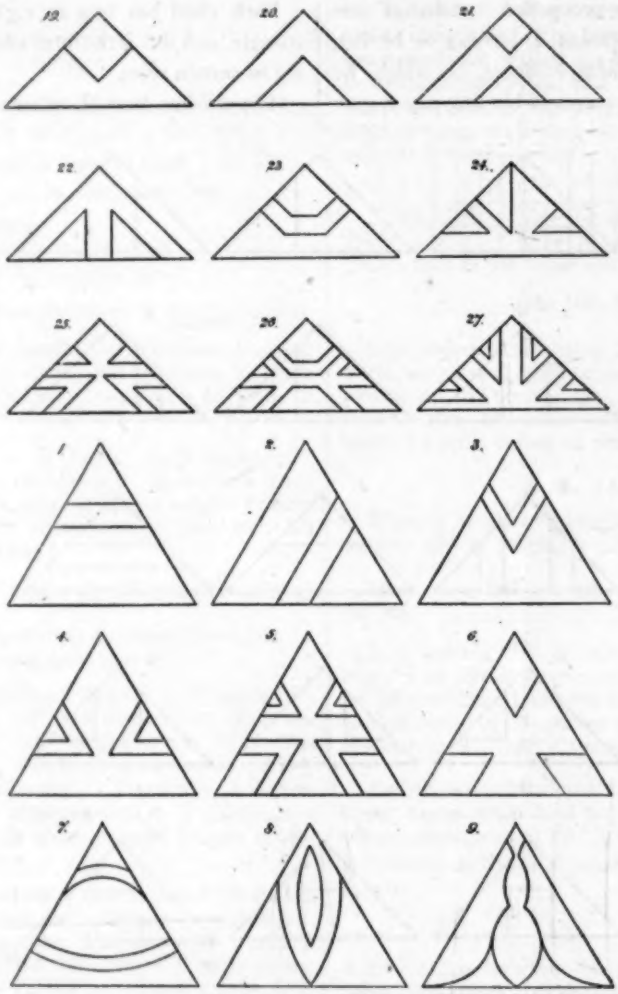


PLATE XXXVII.

The projecting ends that were cut off should be thrown away as they are of no use.

Lines should now be made on this triangle to help the children in cutting. When cut, the pieces should be arranged and mounted as in the first Fundamental Form.

The patterns given for the teacher's use, show many different cuts.

Paper cutting is a very favourite occupation with children, and it is a very useful one, for by its means children learn form, colour and arrangement of different forms, accuracy, neatness and cleanliness in mounting. It also teaches children how to handle sharp instruments (scissors), making them careful to hurt neither themselves nor their neighbours.

GIFT XIV.

PAPER PLAITING, WEAVING OR BRAIDING.

This occupation can be adapted to children of all ages, for simple plaiting can be done by children of 3 years, and, on the other hand, some of the more complicated patterns require all the patience and perseverance of children of 13 and 14 years.

The material consists of:—

1. The Braiding Sheet. This is a sheet of paper cut into slips, leaving, however, a margin all round to hold the slips together; this forms the foundation of the work.

2. The Braiding Strip. This is a strip of paper, the same width as the slips of the braiding sheet and as long as its width.

3. The Braiding Needle. This is a long thin strip of wood pointed at one end and having a slit at the other end for the purpose of holding the strip. Sometimes braiding needles are made of steel.

This occupation is a great favourite with all children, and is at the same time a very important one. The three elements of number, form and colour are constantly before the children. The necessary repetition makes it a great means of improving dull children, *e.g.*, in weaving a mat the children must repeat the same number so many times thus, '2 up, 2 down,' until the mat is completed, that it is impossible for them not to become familiar with this number.

In every piece of braiding at least two different colours are combined, and thus if the colours are judiciously selected the children's taste for colour is cultivated.

Paper plaiting gives occupation to both hands, for the left is also busy most of the time. It may be considered as an introduction to darning, weaving, straw plaiting, &c. It is also a help to dictation, inasmuch as the teacher dictates the pattern, the children listen and do the work under the supervision of the teacher.

Besides all these advantages, the mats when finished can be made into useful little articles such as pin trays, toilet tidies, needle books, blotting books, boxes, spill cases, &c. These the children are delighted to take home and give to their friends as presents of their own handiwork.

The mats for the youngest children should be large, of stiff paper and having wide slips—stiff brown paper is very good for a first mat.

The strips can be plaited with the fingers as the little ones might find it difficult to thread the needle.

The simplest pattern is 1 up, 1 down, and as this will have to be repeated so often it would be as well, for a change, to let the children plait strips of different colours and of different widths alternately broad and narrow strips.

In giving a lesson the teacher should be provided with a very large mat for herself, so that she can work with the children, and they can see what she is doing. The lesson should commence with a little conversation about the different materials and the use of each.

The teacher would then show the children how to thread their needles. When these are ready she should proceed with the braiding, thus—First under the margin, then under 1 strip, or 1 up, and over the next, or one down. The children to say this after the teacher while they work, thus—'1 up 1 down,' '1 up, 1 down,' &c.

When the strip is plaited through the braiding sheet, it must pass under the margin at the other end and be held very firmly while the needle is pulled out. This strip must be pushed well up to the top. The second line must begin in the opposite way, that is, the slip that was pressed down before must be raised now, thus—thread needles, place them under the margin, 1 down, 1 up, 1 down, 1 up, &c. That is to say, if the first strip is 1 up, 1 down, &c., the second strip will be 1 down, 1 up, &c.

Without this combination there would be no braid work, only loose strips. The third line will be the same as the first, the fourth like the second.

A good exercise in counting is to let the children count the little squares the strips make, also they might count the number of lines they have plaited in the mat.

The following are a few of the rules for braiding, and from these many others may be easily invented. They may be classified in three groups. Group 1, Simple Patterns. 2, Combinations. 3, Derivations.

Group 1, *Simple Patterns.* The simplest rule or pattern (1) has already been given, viz., 1 up, 1 down, with its opposite 1 down, 1 up.

Pattern

(2)	2 up, 2 down, with its opposite 2 down, 2 up, &c.									
(3)	2	„	1	„	„	„	2	„	1	„
(4)	3	„	3	„	„	„	3	„	3	„
(5)	3	„	1	„	„	„	3	„	1	„
(6)	3	„	2	„	„	„	3	„	2	„
(7)	4	„	4	„	„	„	4	„	4	„
(8)	4	„	1	„	„	„	4	„	1	„
(9)	4	„	2	„	„	„	4	„	2	„
(10)	4	„	3	„	„	„	4	„	3	„
(11)	5	„	5	„	„	„	5	„	5	„
(12)	5	„	1	„	„	„	5	„	1	„
(13)	5	„	2	„	„	„	5	„	2	„
(14)	5	„	3	„	„	„	5	„	3	„
(15)	5	„	4	„	„	„	5	„	4	„

Group 2, *Combinations.* By combining two or more of the preceding patterns, numerous other patterns are produced, *e.g.*—

Patterns

1 and 2 combined			=	1 up, 1 down, 2 up, 2 down, &c.							
1	„	4	„	=	1	„	1	„	3	„	3	„	„
1	„	5	„	=	1	„	1	„	3	„	1	„	„
1	„	6	„	=	1	„	1	„	3	„	2	„	„

Group 3. *Derivations.* The patterns contained in this group are derived from the preceding two, but they commence irregularly. The 'steps' or 'staircase' patterns belong to this group; these are obtained by moving the pattern on each line one degree either to right or left; *e.g.*, the pattern 2 up, 2 down, would appear thus—

1st line—2 up, 2 down, 2 up, 2 down, &c.
2nd line—1 down, 2 up, 2 down, 2 up, 2 down, &c.
3rd line—2 down, 2 up, 2 down, 2 up, 2 down, &c.
4th line—1 up, 2 down, 2 up, 2 down, 2 up, &c.
5th line—the same as the first, '2 up, 2 down,' &c.

Patterns having a centre design should be commenced at the centre, working alternately above and below the middle strip. This ensures the design being in the middle of the braiding sheet.

When the braid work is completed it is easily converted into pretty and useful articles such as mats, toilet tidies, baskets, pin trays, boxes, spill cases, &c.

The strips plaited in the braiding sheet must be pushed close together, and when the sheet is quite full the ends must be cut even with the edge of the braiding sheet; these ends must then be fastened to the margin. If a sheet of white paper be put at the back of the sheet and the edges bound with coloured paper, or notched out, a very pretty mat will be made.

To make a basket, two pieces of braidwork are required. The ends must be fastened as in making a mat, then one piece of paper is placed between the two mats.

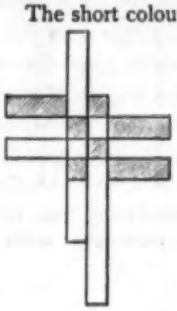
When this is partially dry the edges must be bent up and the corners firmly creased to make the edges stand up all round.

A handle should be made and fastened to the basket. Paper fasteners will be found very useful for this purpose. The basket may be greatly improved by trimming with very narrow ribbon bows.

The making of book marks.—This is a branch of paper plaiting, but it is braiding without the braiding sheet. It is called free braiding. The material consists of long and short strips of paper of the same width.

Two long strips of paper are to be doubled in halves; these to be held in the left hand with one open end and one closed end at the top, and one end about an inch higher than the other.

The short coloured strips (about 4 inches long) are also to be doubled in halves, one to be held in the right hand and placed round the first long strip and inside the second. The long strips then to be turned round so that the coloured horizontal strip is pointing to the right. Another strip to be held horizontally and placed round the first long strip and inside the second. Other strips to be placed until the long strips are full. The ends should then be cut to equal lengths and notched.



(To be continued.)

—o—

How to Teach School Children to Sing from the Staff Notation.

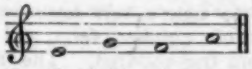
BY W. G. McNAUGHT,

Associate of The Royal Academy of Music.

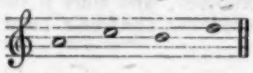
18. Every lesson on tune at this stage should introduce a little theory and a great deal of practice. The theory may now include the alphabetical pitch names of the lines and spaces, a dogmatic explanation of the treble clef, the scale-note naming (without singing) of the lines and spaces from any space or line as **doh**, and an introduction to intervals. The practice should include the singing of easy passages written on the staff and sung to the sol-fa syllables. Unless the time and tune are very easy the two should not as yet be combined in one exercise.

THEORY.

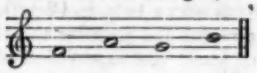
19. In teaching the alphabetical names of the lines and spaces it is best to avoid encouraging pupils to reckon the names from one another. Strive to get them to remember locality. Young people who learn the pianoforte and may therefore be expected to be quick at such a task often exhibit the most curious ignorance or rather forgetfulness of what they have been repeatedly taught. You ask such a pupil the name of the fourth line and you find he begins to answer by naming the first and painfully working upwards until the fourth line is reached. The best way is to work at a few lines or spaces at a time. Say you select the two lowest lines and spaces of the treble clef.



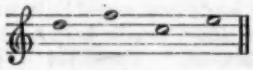
State that the first line is E and the second G. Point to one and the other repeatedly, the class naming. Add F in the first space, and point as before. Ask a pupil to come out and point to G, another to E, another to F. Add A in the second space and repeat all the foregoing processes. Ask how often G, or E, or F, or A, comes in an exercise or piece in a book or chart. At the next lesson work in the same way with the following lines and spaces :—



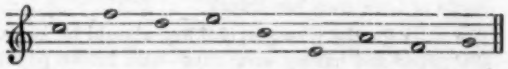
The alphabetical succession can be pointed out, but not much need be made of it in this connection. At the next lesson work with the following :—



Then add the following :—



Then mix high and low as follows :—

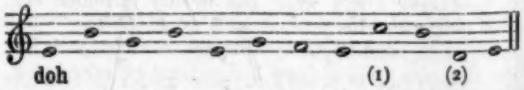


and add the space above the staff and the space and leger line below the staff. Writing from dictation is a valuable exercise, but unless the class is supplied with slates ruled with music lines it is almost impracticable with large numbers. In place of the whole class writing, one pupil should be called upon to write on the blackboard. The process is certain to be followed with the interest and knowledge of the class.

20. The explanation of the treble clef should be brief. It is enough to say that the lines and spaces sometimes stand for low notes and sometimes for high notes, and that when they stand for high notes the sign called a Treble Clef is used, and when they stand for low notes the sign called a Bass Clef is used. Draw both clefs in their proper places.

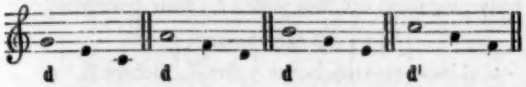
21. The naming of scale notes without singing should be a regular exercise. If the class is not too large and the pupils are well in front of the teacher, much use can be made of the left hand in giving a great variety of exercises. Train the children to take notice at once that if **doh** is on a line **me** and **soh** are on lines (see section 14) and then get them to reckon other notes from these. Thus, suppose the following successions are pointed (the little finger stands for E the first line and the thumb for high F the top line).

Doh on the first line.



At (1) do not allow pupils to slowly climb up the scale but get them to name the note because it is just above **soh**, and at (2) to name the note because it is just below **doh**. Now and then make a special study of the position of some one note in relation to **doh**. Say **fah** is chosen. Ask the class 'If **doh** is in the first space (or on the first line, etc., etc.), where will **fah** be?' Give frequent exercise in naming notes *below* **dohs** somewhat high in

the staff. It is generally more difficult to reckon downward leaps below **doh** than leaps above **doh**. Show that the lines read downwards from **doh** on a line, or the spaces read downwards from **doh** in a space, are low **lah** and low **fah**, and frequently bring out the reverse position of low **soh** (see section 15).



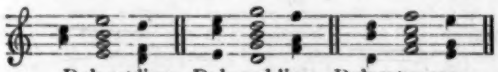
22. As skill advances begin exercises by naming the position of **fah** or **te** or any other note than **doh**. Another step in advance is to change key after every few notes. Of course it would be impracticable for the class to *sing* such exercises at this stage, but as the task is purely to name, its difficulty depends entirely upon the mental vigilance and sharpness of the class and not upon musical skill. The exercise should be given in say this form :

Point a few notes with **doh** in first space. After the **soh** has been named the teacher says 'call it **ne**,' and goes on in that key. Presently another similar change is made and others quickly follow. A specimen exercise is given below. The initial note of each new key is given.

EXERCISE IN NAMING NOTES.

(*To be pointed on the left hand.*)

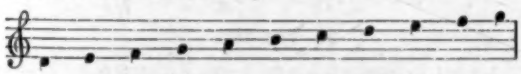
23. Blackboard exercises in naming should accompany or follow on the same plan, but as the writing of notes takes up so much time it is important for the teacher to learn how to make the most of a few exercises. It is a good plan to write out a few columns in the following manner :—



Doh 1st line. Doh 2nd line. Doh 1st space.

that is, write the **doh** chord as a column; group **rays** and **tes** on the right and **fahs** and **lahs** on the left. Show the **doh** chord by 'open' notes and the others by crotchet heads. Use a special coloured chalk for **doh**. Point exercises in each key in turn much as in tonic sol-fa the modulator is used.

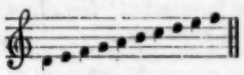
24. Another good exercise in naming is to write a succession of crotchet heads,



and then announcing a position for **doh** elicit the names of other notes pointed to. When the positions of the notes are being named from memory change the place of **doh** again and again as necessary. It is better to have heads of notes to point to than to use a perfectly blank staff, because there is less ambiguity as to which line or space is to be named. Some teachers use a pointer at the end of which a crotchet head is fixed and this they endeavour to place on the line or in the space to be named. But it is difficult to place the head rapidly and exactly where desired. The advantage of pointing to written heads is that the pointer need not be placed exactly on the line or space to be named. It is easy to make it perfectly clear which particular head is pointed *at*.

25. As so much of the intelligent appreciation of the staff depends upon the habit of observing intervals, occasional opportunities should be found to introduce this subject in at least the easiest form. Only the 'numbers' of intervals need be practised at this stage. The memorising of the 'qualities' of intervals is really a very difficult matter for children and at best can be profitably studied only by an upper class of select pupils. But the numbering of intervals is quite easy and interesting to any children who can reckon with fair facility. Begin by pointing out that musical distances are reckoned in a peculiar manner. Whereas the distance between one milestone and another is *one* mile, the distance from one note to the next above or below is called a *second*. Then go on to show that from line to line or from space to space is a third. Point on the left hand many seconds and thirds, the class calling out the numbers of the intervals pointed. When this is thoroughly well done pass on to fourths. The speciality of fourths is that they are *dissimilarly* placed to the note from which they are reckoned. If a note is on a line its fourth above or below must be in a space, and *vice versa*. Give abundant exercises on seconds, thirds, and fourths, *up and down*. Fifths are easy to observe. If reckoned from a line they are on the next line but one above or below, and similarly they are in the next space but one reckoned from spaces. Exercises now follow on seconds, thirds, fourths, and fifths. Sixths are soon learnt because *like all the even number intervals* they go from space to line or from line to space. Sevenths being similarly placed to the note from which they are reckoned are recognised because they *miss* two spaces or two lines. Eighths or octaves (*even* number) are dissimilarly placed, and their great distance apart coupled with the observation that they move from space to line or line to space, soon enables a class to notice and name them. Besides being worked out on the fingers of the left hand, intervals should be occasionally shown in the form of notes. The teacher should make a diagram for permanent use similar to the following :—

Seconds.

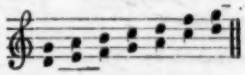


Line to space or space to line.

Thirds.

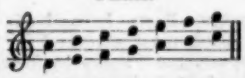
Next line or next space.

Fourths.



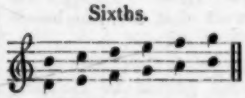
Line to space or space to line.

Fifths.



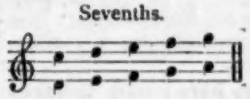
Next line but one or next space but one.

Sixths.



Line to space or space to line.

Sevenths.



Line to line or space to space, miss two lines or two spaces.

(To be continued.)

Our Certificate Class.

BY DR. GEORGE BEACH, M.A.

Head Master of Christ Church Schools, Macclesfield,

Co-author of 'Our Mother Tongue,' &c.

GENERAL REMARKS.

THE NEW CODE.

THE anxiously expected New Code is issued at last, and we may say, *en passant*, that its broad principles are of a higher kind than those of any Code since '66. That cruel Juggernaut, 'Payment by Results,' has received its death blow, and thousands of teachers and hundreds of thousands of children will exultingly be relieved from much needless over-pressure.

Many of the details still are vicious, and with the left hand take away what the right has given; but on the whole the Code will be accepted by Teachers as a marked advance.

Coming nearer home, we find that FOR THE NEXT EXAMINATION ONLY (CHRISTMAS, 1890), TEACHERS WILL BE ALLOWED TO TAKE SECOND YEAR PAPERS WITHOUT HAVING PREVIOUSLY PASSED THE FIRST YEAR EXAMINATION.

There is therefore no time for delay or for leisurely studying, as everyone failing in Second Year Papers next December cannot try again until 1892. Accordingly, all who feel themselves very backward should seriously consider whether it will not be advisable to take First Year Papers this year.

THE ACTING TEACHERS' CERTIFICATE LIST as usual contains but few 'firsts,' although there is a considerable number of 'seconds.' When we consider, however, that only 37 per cent. of the Males in Training Colleges and only 35 per cent. of the Females obtained 'firsts,' despite their superior opportunities, the 'unattached' candidates need feel neither discouraged nor ashamed.

We are very pleased to recognise the names of some of our correspondents who have not personally informed us of their success.

BOOKS, ETC.

1. SPENCER ON EDUCATION.—It appears that we were mistaken in supposing that a synopsis of this treatise would be given in our pages. Reluctantly, therefore, we are compelled to recommend that the work be purchased. We shall devote considerable attention to its elucidation, commencing next month. (Published by Williams and Norgate, 14, Henrietta-street, Covent-garden, London. Price 2s. 6d.)

2. FINDLATER'S PHYSIOGRAPHY, Parts I. and II. (Chambers), is at present the book most favoured for Physical Geography, &c. However, the Papers by Mr. Cowham in the last year's PRACTICAL TEACHER are very helpful, and we are informed that Mr. Hughes is about to publish a very suitable manual.

3. The Model Answers to last year's Certificate Questions, which are now appearing, should be carefully studied, and many valuable hints may be obtained from Mr. Dawson's 'Short Studies in English Literature.' See also 'Query Column,' Arithmetical Solutions 1, 2 and 3, and Algebra.

4. Messrs. Moffatt and Paige have issued 'Solutions of Difficulties in Arithmetic,' a book in which the difficult questions of Arithmetic are thoroughly classified and solved. Over three hundred and fifty problems are worked out in a model style. The book can be thoroughly recommended to Certificate students.

5. Whitaker's Almanac is also very serviceable.

6. A considerable number of provincial correspondents have experienced great difficulty and delay in procuring the recommended manuals. We would advise that these be not ordered from *local* booksellers, but from some educational company. Even if carriage has to be paid, there will be less expense and delay, and our particulars respecting them will then suffice for their description.

PARAPHRASING.

1. (Lines 119—143, Scene 3, Act I., Richard II.)

Command them to put aside their weapons and go back to their seats once more. You shall retire and consult with us. Meanwhile let there be a flourish of trumpets until we shall resolve what to do respecting these nobles. . . . Approach, and hear our decision, and that of our advisers. We exile you from our dominions for the three following reasons: *First*, because we are not willing that lives so important to our land should pollute it by being therein destroyed. *Second*, because we cannot endure the hateful sight of fellow-citizens slaying one another. *Third*, because we think that you both are incited by high-soaring vanity—etc.

2. (Lines 154—173, Scene 3, Act I., Richard II.)

My king and master, you have condemned me to a heavy punishment, such as I should never have expected from your majesty's hands. From you my services merited better recognition than to be exiled from my own country and stripped of my position. No more shall I speak English, my 'mother tongue,' which for twoscore summers I have used. As I am ignorant of foreign languages, my tongue will be as useless to me as a stringless fiddle, and as dumb as a locked-up harp, or like an instrument of difficult execution given to one unskilled in its manipulation—etc.

3. (Lines 274—293, Scene 4, Act I., Richard II.)

Every spot under the sun is to the philosopher a shelter and a pleasant refuge. The force of circumstances (and there is nothing so persuasive as the inevitable) should instruct you to argue as follows:—'I have not been exiled by the king, but have left England of my own accord.' Grief presses but lightly upon the enduring mind—etc.

4. (Bacon's Essays, No. XXXII., final paragraph.)

A judicious discourse is more effective than a fluent oration, and a speech suitable to the occasion than one merely well expressed or well arranged—etc. (*Mr. Lewis' notes, 20 and 21, of this Essay are so good as to obviate the necessity of extending this model.*)

5. (Lines 329—348, Lancelot and Elaine.)

Throughout the night she vividly saw his countenance; and like an artist who, after studying the features, penetrates by his genius through the mere form, discerns the character of the person, and then so depicts him that his lineaments preserve for his descendants in the noblest manner the ideal beauty of his disposition and career—so his countenance appeared to her—etc.

PARSING.

1. (Act I., Scene 3, Lines 85—96, Richard II.)

However, cast, there, true, gentleman, cast, off, more, than, peers, as, as.

2. (Act II., Scene 1, Lines 93—108, Richard II.)

Now, that, knows, ill, seeing, no, than, wherein, sick, thou, too, patient, as, whose, than, head, incaged, whit, O, how, forth.

3. (Act II., Scene 1, Lines 235—245, Richard II.)

Good, do, unless, good spoiled, now, afore, shame, borne, prince, moe, himself, led, what, all, that, hers.

4. (Act II., Scene 3, Lines 1—18, Richard II.)

Draws, wearisome, as, making, me, company, theirs, hope, enjoyed, seem, have, company.

ROUTINE FOR MAY (MALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	Algebra. — Revision	History. — Dates from 1189 to 1307 Plantagenet Dynasty	School Management. — Draw up a weekly routine for a town school of 250 average. Staff—Head, 2 Assistants and 3 Pupil Teachers	Algebra. — Involution and Evolution	History. — Outlines from 1307 to 1399	School Management. — Notes of a Lesson on Short Division	Algebra. — Fractions	History. — Outlines from 1399 to 1461	School Management. — Formation of Habits and Character, pp. 91 to 103, Coupland	Algebra. — Government Questions (See Article)	History. — Outlines from 1461 to 1485 and Revision	School Management. — Posture and Position of Teachers and Scholars. Forms of Recreation
TUESDAY	Euclid. — Revise Book I.	Map. — Scotland	English. — Paraphrase Lines 119 to 143, Scene III., Act I., Richard II.	Euclid. — Revise Deductions of Book II.	Map. — New South Wales	English. — Paraphrase 'Discretion of speech is more than eloquence . . .' to end of Essay.—Bacon's Essays, No. XXXII.	Euclid. — First 29 Propositions of Book III.	Map. — Hindostan (Political)	English. — Paraphrase Lines 329—348 Lancelot and Elaine	Euclid. — First 55 Deductions in Egan, Part II.	Geography. — Vapour Clouds and Rain	English. — Paraphrase Lines 154—173, Scene III., Act I., Richard II.
WEDNESDAY	Arithmetic. — Discount	English. — Write 20 lines of Composition on Lines 33 and 34 of Scene II., Act I., Richard II.	Euclid. — Revise Deductions on Book I.	Arithmetic. — $\sqrt{4}$, $\sqrt{6}$, $\sqrt{8}$, $\sqrt{9}$, &c.; contracted methods of $\sqrt[2]{}$ and $\sqrt[3]{}$	English. — Write 20 Lines of Composition on 'The Character of Bacon.'	Euclid. — First 23 Propositions of Book III.	Arithmetic. — Stocks	Algebra. — Revise and learn to prove the required formulæ	Euclid. — First 40 Deductions of Egan, Part II.	Arithmetic. — Sums with A, B and C working at different rates, or taps of different capacities	English. — Richard II. to end of Scene IV., Act III.	Euclid. — Revise Book III.
THURSDAY	School Management. — Reasoning, pp. 1—20, Jevon's Logic Primer	Geography. — Our Asiatic Possessions, excluding India	English. — Richard II. to end of Scene III., Act II.	School Management. — Spencer on Education. (See Article thereon)	Geography. — Our South African Possessions	English. — Lines 505—696 of Lancelot and Elaine	School Management. — In a mixed School containing Half-Timers, how would you distribute the various kinds of exercise and study weekly?	Geography. — Our South African Possessions	English. — Richard II. to end of Scene II., Act III.	School Management. — Spencer on Education (See Article thereon)	Geography. — Effect of Climate upon Industry	English. — Lines 696—872 of Lancelot and Elaine
FRIDAY	Algebra. — Simultaneous Equations	History. — Reign of Henry VIII., pp. 21—39, Davies	Writing. — 1 Dictation 2 Copy Book Writing 3 Word or passage previously set	Algebra. — Factorising	History. — Literature, pp. 173 to 179, Davies	Arithmetic. — Relation to each other of Interest, Discount, and Present Worth	Algebra. — Quadratic Equations	History. — Reign of Edward VI., pp. 60—75, Davies	Geography. — Revise our Asiatic Possessions	English. — Write 20 lines of Composition on 'The Marian Persecution'	History. — Revise	English. — Bacon's Essays, 27, 28 and 29
SATURDAY	Euclid. — Revise Book II.	English. — Bacon's Essays, 17—19	School Management. — Drainage, to end of p. 50 of Carpenter's Hygiene	Geography. — The Atmosphere	Euclid. — First 16 Deductions in Egan, Part II.	Examination — Miscellaneous (See Article)	School Management. — The Attendance Register. Revise Circular 217	Euclid. — All Book III.	English. — Bacon's Essays, 21, 24 and 25	Algebra. — Government Questions. (See Article)	Geography. — Effect of Climate on Productions	History. — Lives of Great Men, pp. 185—189, Davies	Examination — Miscellaneous (See Article)	English. — Lines 872 to 1055 of Lancelot and Elaine

ROUTINE FOR MAY (FEMALES).

DAY	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
MONDAY	**Arithmetic.** — Vulgar and Decimal Fractions	**History.** — Dates 1641 to 1649. Curtis' Date Book	**School Management.** — Draw up a weekly Routine for a Town School of 250 average. Staff—Head, 2 Assistants, and 2 Pupil Teachers	**Arithmetic.** — Compound Interest	**History.** — Reign of James II.	**School Management.** — Notes of a Lesson on Short Division	**Arithmetic** — Real per cent. obtained by investing in Stocks	**History.** — Plots against James I.	**School Management.** — Formation of Habits and Character, pp. 91 to 103, Coupland	**Arithmetic.** — Revise Discount, p. 177, Capel's Catch Questions	**History.** — Inventions, Discoveries, Trading Companies of James I.	**School Management.** — Posture and Position of Teachers and Scholars, Forms of Recreation
TUESDAY	**Domestic Economy.** — The ordinary Beverages	**Geography** — Map of South Africa shewing British Possessions	**English.** — Paraphrase Lines 119—143, Scene 3 Act I., Richard II.	**Domestic Economy.** — How should food for invalids differ from ordinary food?	**Geography.** — Maps of Cape Colony and Natal	**English.** — Paraphrase Lines 274—293, Scene 4. Act I, Richard II.	**Domestic Economy.** — How would you plan out for a month the work of a 4s. per week house? (No servant)	**Geography.** — Map of British West Africa	**English.** — Analyse and Parse difficult words of lines 93—108, Scene 1, Act II., Richard II.	**Domestic Economy.** — What apparatus is needed for an Elementary School Cooking Class? Sketch out the first six lessons of a suitable course	**Geography** — Revise	**English.** — Paraphrase Lines 154—173, Scene 3, Act I., Richard II.
WEDNESDAY	**Arithmetic.** — Proof of Rules in Fractions	**English.** — Write 20 Lines of Composition on Lines 33 and 34, Scene 2, Act I., Richard II.	**Sewing, etc.** — Learn the measurements and draw a diagram of 'a boy's shirt'	**Arithmetic.** — Insurance and Percentages	**English.** — Write 20 Lines of Composition on 'Shakespere's Historical Plays'	**Sewing, etc.** — Cut out and tack together half the front and half the back (with sleeve) of a boy's shirt	**Arithmetic** — Problems on difference of Income resulting from Stock operations	**Sewing, etc.** — Practise 'felling,' 'gathering,' 'stroking,' and 'setting-in'	**Domestic Economy.** — State fully the duties and qualifications of a sick nurse	**Arithmetic** — Square Root of Fractions	**Sewing, etc.** — Learn the measurements and draw a diagram of 'a woman's night-dress'	**Domestic Economy.** — Describe any good system of Penny Banks
THURSDAY	**School Management.** — Reasoning, pp. 1—20 Jevon's Logic Primer	**Geography.** — Hong-Kong, Labuan, Straits Settlements	**English.** — Notes and Text of Richard II. to end of Scene 2, Act III.	**School Management.** — Spencer on Education	**Geography.** — Cape Colony and Natal	**English.** — Analyse and Parse difficult words of lines 85—96, Scene 3, Act I., Richard II.	**School Management.** — In a Mixed School containing Half-Timers how would you distribute the various kinds of study and exercise weekly?	**Geography.** — British South Africa	**English.** — Notes and text of Richard II. to end of Scene 4, Act III.	**School Management.** — Spencer on Education	**Geography.** — British African Islands	**English.** — Notes and text of Richard II. to end of Scene 1, Act IV.
FRIDAY	**Arithmetic.** — Interest	**History.** — Literature, etc., Davies, pp. 92 to 98 (see Article)	**Writing.** — 1. Dictation. 2. Copy Book, 3. Copy previously set.	**Arithmetic.** — Government Questions. (see Article)	**History.** — The Commons 'Apology,' Hampton Court Conference, 'Book of Sports'	**Sewing, etc.** — Practise 'running tucks' and making 'button-holes'	**Arithmetic** — Relations to each other of Interest, Discount and Present Worth	**History.** — Colonisation of Virginia, New Plymouth and Ulster	**Any backward work**	**English.** — Write short lives of— 1. Strafford, 2. Jeffreys and 3. Blake	**History.** — Dates 1649 to 1660 Curtis' Date Book	**Sewing, etc.** — Practise 'whipping' and 'sewing on frills'
SATURDAY	**Domestic Economy.** — What ordinary food compounds are typical foods scientifically considered?	**English.** — Trench, Lecture II.	**School Management.** — Drainage, To end of p. 50 of Carpenter's Hygiene	**Geography** — Revise	**Sewing, etc.** — Practise the different stitches on a piece of calico 9 ins. sq.	**Examination** — Miscellaneous (see Article)	**School Management.** — The Attendance Register. Revise Circular 217	**Domestic Economy.** — A peasant with wife and 4 children earns 16s. per week. How can this be eked out?	**English.** — Trench One-third of Lecture III.	**Geography** — British West Africa	**Sewing, etc.** — Cut out and tack together the upper parts of half the front and half the back of a woman's night gown (with yoke)	**History, Literature, etc.** — Davies, pp. 98 to 105 (see Article)	**Examination** — Miscellaneous (see Article)	**English.** — Trench, Two-thirds of Lecture III.

GOVERNMENT QUESTIONS ON RICHARD II.

PREVIOUSLY SET.

(*a*) *Act III., Scene* 2, *Lines* 160—170; (*b*) *Act V., Scene* 5, *Lines* 18—27.

1. Point out in the above excerpts words or phrases that are too metaphorical or fanciful, or expressions that are too condensed for ordinary prose, and explain or amplify them briefly.

2. Select six of the following words and show the change that they have undergone in meaning since the age of Shakespere:—*incontinent, silly, humours, pompous, property, prodigy, conceit, scarcely, apparent, owe.*

3. What peculiarities may be noticed in Shakespere's use of relative and reflexive pronouns, and of the comparative degree? Name also some obsolete forms of past participles that occur in this play.

4. Derive the words *sterling, Hallowmass, forego, caitiff, attorney, sympathy, attainder.*

5. Explain six of the following:—*music at the close—pressed to death—fantastic summer's heat—the world is full of rubs—words of sooth—redeem from brokering pawn—which God defend—there is no boot.*

HISTORY.

Males.

(1) (Davies, pp. 173 to 179.)

Simply read pp. 173—178, and master lives of Caxton and Bacon.

(2) (Davies, pp. 185 to 189.)

Omit Lives of Lord Audley, Lady Catherine Grey, and Edward Vere, Earl of Oxford.

Females.

(1) (Davies, pp. 92 to 98.)

These lines are very important, and should be re-studied as opportunity affords.

(2) (Davies, pp. 98 to 105.)

Pages 101 and 102 of dates should be thoroughly committed to memory, as by means of them the thread of events will be well comprehended.

Selected Government Questions on the month's History.

Males.

1. Sketch the rise of Parliament up to the reign of Edward III. (1870.)

2. The life and character of the Black Prince. (1870.)

3. The causes of public discontent which led to the insurrection of Wat Tyler. (1870.)

4. The life and fortunes of Margaret of Anjou. (1870.)

5. The extent of the French possessions of our crown from 1272—1485. (1870.)

6. What are the chief authorities for the Plantagenet Period? (1870.)

7. The claims of Henry VII. to the crown, and the terms of the settlement by Parliament. (1870.)

8. The pretensions of Perkin Warbeck; his invasion; the support afforded by the Scots and Burgundians. (1870.)

9. The political character of Henry VII., the improvements in law and commerce during his reign. (1870.)

10. The war (1512—1514) with France. (1870.)

Females.

1. The proceedings in the first Parliament of James I. on the question of Privilege. (1870.)

2. The surrender of the 'cautionary towns' to the Dutch. Explain what they were, and discuss the expediency of their surrender. (1870.)

3. The revenues of the crown in the reign of James I. What was the state of the public exchequer at the death of Cromwell? (1870.)

4. The progress of the power of Parliament in the reign of Charles I. (1870.)

5. Some account of Strafford, Laud, Prince Rupert, and John Milton. (1870.)

6. Cromwell's campaign in Ireland. (1870.)

7. Give an account of the battle of Worcester. (1870.)

8. The Savoy conference, its objects and results. (1870.

9. The Corporation Act and the Act of Uniformity, their consequences. (1870.)

10. Describe the Dutch War of 1666. (1870.)

GEOGRAPHY.

One of the most valuable hints, although a commonplace one, that any one can offer, is that in studying this subject special attention should be directed to places prominently brought into notice by current or recent events.

To the student of the Certificate Questions, the remarkable coincidence between these and contemporaneous politics is most interesting.

Therefore, without devoting undue time to the pursuit, the student who intelligently reads his newspaper will score a great advantage over one who is ignorant of present and recent events.

Males should therefore carefully attend to the geography of Burmah, Australia, South and Western Africa, and commercial geography in general; *females* to 'Effect of climate on industry, productions and natural character,' the Balkan Peninsula, Portugal, and Turkey in Europe.

ALGEBRA.

Answers to April Questions.

(2) $x^2 - (a + b)x + ab$.

(3) $x^2 - 3x + 1$.

(4) $-\frac{4y^6}{x^6 - y^6}$.

(5) 0.

(7) $x^2 + 2x + 3$.

(8) 0.

ARITHMETIC.

Females.

(1) $19\frac{1}{2}$ mins. past 10 p.m.

(2) Men, £1 5s.; women, 15s.; boys, 12s.

(3) $5\frac{5}{11}$ mins. past one; $38\frac{5}{11}$ mins. past 7.

(4) £5,948 15s. 0d.

Males.

(13) $66\frac{1}{3}$.

(14) 64·63.

SHORT NOTES ON LAST MONTH'S QUESTIONS.

Clock Sums.—The following principles should be thoroughly understood:—

1. The big finger gains 55 minutes per hour on the little finger.

2. At exactly 1, 2, 3 o'clock, etc., the little finger has 5, 10, 15 mins., etc., start respectively.

3. *Between* 11 and 12 o'clock, and *between* 12 and 1 o'clock, the large hand does not pass the small hand. This transit takes place exactly AT 12 o'clock.

4. From 3 it follows that the big finger coincides with the little one, and passes the little one, only eleven times in the twelve hours.

5. There being 60 minutes round the clock, and 360 degrees in a circle, every minute represents 6°. Thus by turning degrees into minutes, it is easy to calculate at what times the hands are at a given angle.

For all angles less than 180° there are *generally* two answers to each question.

6. Two clocks are set going at noon, the first loses 10 minutes per day, the second gains 20 minutes per day. What time will the former indicate when the latter strikes eight at night?

Second clock goes 1460 mins. per day.

$\therefore$ True time $= \frac{1}{1460} \times \frac{1}{1460} = \frac{3}{4}$ of its indicated time.

First clock goes 1430 minutes per day.

$\therefore$ Its indicated time $= \frac{1}{1430} \times \frac{1}{1430} = \frac{1}{1431}$ of true time.

True time when second clock strikes eight $= \frac{3}{4}$ of 8 hrs.

$\therefore$ Time indicated by first clock $= \frac{1}{1431} \times \frac{3}{4} \times \frac{480}{1}$ mins.

$= 7$ hrs. $- 50\frac{10}{11}$ mins.

Mensurational Arithmetic.

Although many of our candidates are not taking Mensuration they must be prepared for questions on simple rectangular solids and surfaces, as these afford the best problems on cube root and square root. Particularly must be noted—

1. The *area* of a square being given in square poles, yards, feet or inches, its side may be found by extracting the square root—

2. The property of Euclid I. 47, *i.e.*, that the sum of the squares on the sides of a right-angled triangle is equal to the square on the hypothenuse—

Example: The two sides of a right-angled triangle are 3 ft. and 4 ft. respectively. What is the length of the hypothenuse?

$3^2 + 4^2 =$ sq. of hypothenuse.

$9 + 16 = 25 =$ sq. of hypothenuse, $\therefore 5 =$ length of hypothenuse—

3. The length of the diagonal of a square or oblong (rectangle) may be obtained from 2. The diagonal is the hypothenuse of a right-angled triangle whose sides are two adjacent sides of the square or oblong—

4. The solid content of a cube being given in cubic yards, feet, or inches, its side may be found by extracting the cube root—

5. From 3 and 4 the diagonal of the surface of a cube may be found, the solid content being given—

6. From 4 and 5 the diagonal of a cube may be found, the area being given—

This diagonal is the hypothenuse of a right-angled triangle formed by one of the sides and the diagonal of the square surface of the cube.

ALGEBRA.

(*a*) Many students are baffled by problems being expressed in ordinary language, whereas if they were stated for them as in algebraic examples no difficulty would be experienced.

In converting an equation from the literary to the algebraic form much assistance will be obtained from perusing—

Capels Tips in Algebra, pp. 13—16, Hamblin Smith's Algebra, pp. 51—53, and Hall and Knight's Algebra, pp. 58—64.

(*b*) We note a tendency to evade problems with literal co-efficients. This should be carefully guarded against.

(*c*) The following results should be carefully committed to memory:—

(1) $(a + b)^2 = a^2 + 2ab + b^2$;
(2) $(a - b)^2 = a^2 - 2ab + b^2$;
(3) $(a + b)(a - b) = a^2 - b^2$;
(4) $(a + b)(a + c) = a^2 + a(b + c) + bc$;
(5) $(a \pm b)^3 = a^3 \pm 3a^2b + 3ab^2 \pm b^3$;
(6) $(a \pm b)(a^2 \mp ab + b^2) = (a^3 \pm b^3)$.

N.B.—By means of double signs we may conveniently compare results and utilise space, the top sign in the one instance and the bottom sign in the other being invariably taken throughout the equation.

(*d*) The general form of $(a \pm b)^n$ may be obtained by the binomial theorem, of which more later on.

(*e*) By experiment it will be readily found that the general form of—

$$\frac{a^n \pm b^n}{a \pm b} = a^{n-1} \mp a^{n-2}b + a^{n-3}b^2 \mp a^{n-4}b^3 \ldots + b^{n-1}$$

where n is not even, and a and b connected by the positive sign.

(*f*) $(a + b + c + d)^2 = a^2 + b^2 + c^2 + d^2 + 2ab + 2ac + 2ad + 2bc + 2bd + 2cd$.

Selected Government Questions for Saturday, 3rd week, and Monday, 4th week.

(Time, two hours.)

1. A farmer has a number of hurdles, 6 ft. long; he finds that by arranging them so as to enclose a given space of ground, if he place them one foot distant from each other, he has not enough by 80, but if he place them a yard apart he has 50 hurdles to spare. How many had he? (1870.)

2. A goods train travels at the rate of 8 miles an hour; at the end of 12 hours it meets a passenger train travelling in the opposite direction, which arrives at the original starting station 16 hours after the goods train had left. At what rate is the passenger train travelling? (1871.)

3. A and B start to run a race; at the end of 5 minutes when A has run 200 yards, and has outstripped B by 75 yards, he falls; but though he loses ground by the accident, and for the rest of the course makes 20 yards a minute less than before, he comes in only 30 seconds behind B. How long did the race last? (1872.)

4. $\sqrt{2x} + \sqrt{2x - 3} = 3$. (1874.)

5. $\sqrt{\frac{a + x}{a - x}} + \sqrt{\frac{a - x}{a + x}} = \sqrt{5}$. (1875.)

6. $\begin{matrix} x^2 - 9y^2 + 266 = 0. \\ x - 3y + 14 = 0. \end{matrix}$ (1876.)

7. Find the sixth root of $x^6 - 12x^5y + 60x^4y^2 - 160x^3y^3 + 240x^2y^4 - 192xy^5 + 64y^6$. (1877.)

8. $\begin{cases} x^2 + y^2 + 2x + 2y = 56 \\ xy - x - y = 4 \end{cases}$

MISCELLANEOUS AND SELECTED GOVERNMENT QUESTIONS FOR SECOND AND FOURTH SATURDAYS.

Males.

(Time four hours.)

1. In the study of Arithmetic, what kind of mental power is specially called into exercise? Give an example of the mode in which you would teach '*Short Division*' with a view rather to the intellectual training of the learner than to the attainment of a correct answer to a sum. (1882.)

2. What part of the moral character of a child is specially within the range of the teacher's influence? Mention any means other than direct lessons, by which you hope to aid in the formation of right principles and habits among your scholars. (1882.)

3. On what principle would you classify your scholars, if you were called on to organise an entirely new school? Say what advantages (if any) there are on making a separate classification for special subjects; and what are the reasons in favour of the ordinary practice of keeping the same scholars together for the whole of their instruction. (1883.)

4. Write a brief essay on 'The Post Office.' (1883.)

5. Which appear to you the finest portions of Richard II.? How do they illustrate the genius of Shakespeare? (1883.)

6. Point out the grammatical peculiarities of the following:—grace me no grace—me rather had my heart might feel your love—deposed 'tis doubt he will be—to do what service am I sent for hither?—I have a king here to my flatterer—I'll lay a plot shall show us all a merry day—dost thou teach pardon, pardon to destroy?—silly beggars sitting in the stocks refuge their shame, that many have, and others must sit there. (1884.)

7. Draw a map of South Africa or Scotland. (1883.)

8. What nationalities are largely mixed with the English in Cape Colony, Canada, Mauritius, Trinidad, New Zealand, Malta and Barbadoes? (1883.)

9. Describe the climate of the West African Settlements. Name their chief articles of trade and describe their means of communication with the interior of Africa. (1885.)

10. Name in order the chief events of the years 1645—1649. (1878.)

11. Trace the descent of Henry IV. from Henry II. (1872.)

12. Describe the policy of Henry VII. and that of Henry VIII. towards Ireland. (1878.)

13. A put into a partnership £4,815 for 1 year and 5 months; B put in £3,531 for 2 years and 1 month; C put in £6,099 for 10 months. Their profit was £1,926. What was the share of each? (1883.)

14. A bicyclist ran 4¼ miles in 17 minutes. The distance made in the last minute was ⅓ of that made in the first minute; and the distance in each successive minute was less than that made in the preceding minute by the same quantity. Find the average and the decrease per minute. (1883.)

15. Prove the following construction for trisecting a line:—The side AC of an equilateral triangle ABC is produced to D, so that CD is half AC. On CD, BC is described a parallelogram CDEB and AE cuts BC at F. Then BC is trisected at F. (1883.)

16. Prove Propositions, Euclid III., 18 and 22. (1883.)

Females.

Questions 1—10 inclusive, as for males.

11. Describe the characters of Blake and Marlborough, OR the siege of Londonderry. (1878.)

12. Name authors in the times of the Stuarts who composed works during imprisonment or banishment, and state the cause of disgrace of each. (1878.)

13. Describe the method by which you would teach a child the right way to darn a hole in the foot of a coarse worsted sock, and to mend a tear made across a child's frock. (1879.)

14. Give a recipe for making a good and cheap soup with and without meat. Why is soup not a popular article of diet in English cottage homes, and why is it desirable it should become so? (1879.)

15. What are the changes that food undergoes from the time that it is eaten until it is absorbed into the system? (1881.)

16. State, with accurate items, the cost, profit and benefit to a peasant of a cow, a pig and poultry. (1882.)

CORRESPONDENCE.

We shall be pleased to reply briefly and through this column to any seeking information or advice. Endorse 'CERTIFICATE EDITOR' *if directed to office.*

Replies demanding urgency will be promptly forwarded per post on receipt of stamped and addressed envelope. This privilege does not extend to furnishing the solutions and answers of examination questions. A post will be saved by addressing direct to Macclesfield.

Any suggestion tending to the greater utility and interest of these articles, or to the greater convenience of 'COACH' *or* PUPIL, *will be thankfully received and thoughtfully considered.*

H. L. (Tunstall).—Many thanks for permission. We wish you continued success.

P. PRY (Hitchin).—You must read, recite and teach again. These, under the circumstances, should be done as soon as possible.

M. MATTHEWS (Timperley), C. W. (Reddish), K. R. (Penzance), and R. BEESLEY (Birmingham).—See our remarks this month under heading 'New Code.'

P. WILKINS (St. Neots).—You can sit again this Christmas.

GRATEFUL (Shrewsbury).—(1.) We cannot undertake to recommend you a tutor. (2.) University Correspondence College, Cambridge.

A. B. (Ripon).—He should first pass the Cambridge Junior and Senior Local with distinction.

C. M. (Reading).—Your letter was not prepaid, and cost us twopence.

ALICE (Wolverhampton), STUDENT (Canterbury).—WE DO NOT TAKE PUPILS BY CORRESPONDENCE, OR OTHERWISE.

ASPER (Barrow).—(1) Thanks for your appreciative remarks. (2) See answer to P. Wilkins.

PHILO (Walsall).—You cannot take Political Economy.

G. S. C. (Stapleton Road).—We are obliged by your courtesy and commendations.

J. E. D. (Louth).—(1) Many thanks for enclosure. (2) We have had many mistakes of the same kind. They are easily committed.

'A. JONES' (Tredegar).—We will announce the date later on.

S. J. (Chester).—A trained teacher has the best chance.

FILIUS (Bristol).—See our 'General Hints.'

S. K. M. (Chatham).—The exercises mentioned will be sufficient.

J. E. D. (Louth), MSS. (Sunderland), C. P. P. (Astbury), M. Q. (Smethwick), C. C. (The Hyde, London), NEMO (Wigan), H. B. C. (Bingley), J. T. J. (Rhos, Ruabon), T. J. (Pontardulais), A. D. F. (Worthing), M. D. (Salford), T. R. W. (Congleton), C. H. (Harlesden), R. J. L. (King's Lynn), R. K. S. (Burnley), F. W. (Croydon), R. T. B. (Chorlton-on-Medlock), answered per ordinary letter.

(To be continued.)

—o—

Contracted Arithmetic.

BY J. L. RICHARDSON.

SECTION IX.

Multiplication by 5, 9, 11, 15.

To multiply by 5.—Add a cypher to the right of the multiplicand and divide by 2.

To multily by 9,—Add a cypher to the multiplicand, and from the result subtract in turn each figure to the left of the cypher, or in other words—multiply by 10, and deduct the multiplicand from the result. (See also Section XV.)

To multiply by 11.—Annex a cypher as above, but *add* each figure on the left. This is equivalent to taking the multiplicand ten times and once more.

To multiply by 15—Annex a cypher to the multiplicand, and to the result add half of itself, or, attach a cypher, and to the result add five times each figure to the left, or, double the multiplier and halve the multiplicand. (See Sections X. and XII.)

Example:—5,638 × 9. Affixing a cypher we have 56,380. Then 8 from 0, or 10, leaves 2, which put down as the right hand digit of the answer. Carrying 1 to the 3 we have 4 to subtract from 8, leaving 4 as the second digit in the answer. Then 6 from 13 leaves 7 as the third figure, and one carried to the 5 makes 6 to take from the 6, leaving 0 as the fourth digit. Then 0 from 5 leaves 5 to complete the answer 50,742.

EXERCISE XII.

By 5. 1. 83,467. 2. 376,201. 3. 48,376.
4. 58,236,904. 5. 260,047,382.
By 9. 6. 73,860. 7. 82,976. 8. 572,031.
9. 279,183. 10. 60,175,348.
By 11. 11. 97,386. 12. 421,383. 13. 570,312.
14. 752,834. 15. 6,284,037.
By 15. 16. 3,824. 17. 16,948. 18. 54,936.
19. 27,152. 20. 4,296,730.

SECTION X.

Multiplication by 13 to 19.

Multiply by the right hand figure, adding to each calculation the figure to the right, or, annex a cypher, and to the result add 3, 4, 5, &c., times the multiplicand. These, as will be seen, are simply abridgments of the ordinary method of long multiplication.

Example:—4,273 × 17. Seven threes are twenty-one; one down and carry two. Seven sevens, three on the right, and two carried make fifty-four. Four down and carry five. Seven twos, seven to the right, and five carried made twenty-six. Six down and carry two. Seven fours, two to the right, and two carried make thirty-two. Two down and carry three. We now go a step further and say—seven noughts, four to the right, and three carried make seven, which put down as the concluding figure of the answer. Worked by the second plan the sum would appear thus:—

42,730. Ten times 4,273 by adding *o*.
29,911. Seven times 4,273.
72,641. Answer.

EXERCISE XIII.

1. 34,285 × 13. 2. 47,829 × 14.
3. 76,439 × 15. 4. 529,014 × 16.
5. 54,176 × 17. 6. 81,095 × 18.
7. 620,483 × 19. 8. 481,762 × 13.
9. 38,123 × 14. 10. 7,108,623 × 15.
11. 104,285 × 16. 12. 701,346 × 17.
13. 576,218 × 18. 14. 908,070 × 19.
15. 224,178 × 13. 16. 345,678 × 14.
17. 137,962 × 15. 18. 987,654 × 16.
19. 819,273 × 17. 20. 908,172 × 18.

SECTION XI.

Multiplication by 21 to 91.

Careful consideration of the preceding section will make clear the following rule:—Set down the right hand figure of the multiplicand. Then multiply the *whole* by the tens figure of the multiplier, adding to each result the figure on the *left*.

Example:—9,427 × 71. Put down 7 as the right hand figure of the answer. Then seven sevens, with two on the left, make fifty-one, one down and five to carry. Seven twos, with four on the right, and five carried, are twenty-three. Three down and two to carry. Seven fours, with nine on the left, and two carried, are thirty-nine. Nine down and three to carry. Seven nines, with nought on the left, and three carried, are sixty-six, which put down in full to complete the answer 669,317.

EXERCISE XIV.

1. 2,764 × 21. 2. 5,428 × 31.
3. 6,428 × 41. 4. 37,192 × 51.
5. 541,023 × 61. 6. 415,234 × 71.
7. 796,182 × 81. 8. 853,012 × 91.
9. 982,763 × 21. 10. 815,478 × 31.
11. 763,841 × 41. 12. 640,291 × 51.
13. 594,837 × 61. 14. 423,109 × 71.
15. 376,285 × 81. 16. 263,849 × 91.
17. 109,623 × 21. 18. 8,162,397 × 31.
19. 7,391,628 × 41. 20. 9,091,763 × 51.

SECTION XII.

Multiplication by 25, 35, 45, 55.

If these multipliers be doubled we have 50, 70, 90, 110, which are of course easier to deal with than the original numbers, but the products formed therefrom would be double the required quantities. To correct this we divide the double result by two, and obtain the rule—double the multiplier and halve the answer.

Example:—5,864 × 45. Twice 45 are 90, therefore multiply by 9 and add a cypher to the result, 527,760 (Section VII.). This divided by 2 gives 263,880. The multiplier 25 may be used in a yet shorter manner, for, as it is a fourth of 100, we need only add two cyphers to the multiplicand and divide the result by four.

EXERCISE XV.

By 25. 1. 6,023. 2. 7,083. 3. 45,678.
4. 98,270. 5. 65,243. 6. 81,025.
7. 65,942. 8. 725,941. 9. 931,572.
10. 581,927.
By 35. 11. 612,904. 12. 751,863. 13. 234,567.
14. 481,042. 15. 583,642.
By 45. 16. 102,846. 17. 230,874. 18. 351,029.
19. 627,841. 20. 749,186.
By 55. 21. 31,924. 22. 908,012. 23. 765,432.
24. 123 456. 25. 910,248.

SECTION XIII.

Multiplication by 65, 75, 85, 95.

By doubling the above numbers we find that we can treat them as in multiplication by 13, 14, 15, &c. (Section X.). As to the number 75, if doubled twice or multiplied by four, it becomes 300, when as 75 is a fourth of 300 we might add three cyphers to the multiplicand, multiply by 3, and divide the result by 4, or simply attach two cyphers and subtract from the result one-fourth of itself.

Example:—3,642 × 75. Answer 273,150.

(*a*)
3,642
300 = 75 × 4
4)1,092,600
273,150

(*b*)
4)364,200 multiplied by 100.
91,050 one-fourth deducted.
273,150

EXERCISE XVI.

By 65.	1. 48,102.	2. 351,628.	3. 74,810.
	4. 238,014.	5. 572,698.	
By 75.	6. 235,861.	7. 742,805.	8. 342,781.
	9. 360,452.	10. 819,013.	11. 34,286.
	12. 947,234.	13. 518,273.	14. 691,489.
	15. 281,049.		
By 85.	16. 109,546.	17. 239,481.	18. 372,654.
	19. 519,286.	20. 678,876.	
By 95.	21. 319,146.	22. 682,481.	23. 572,964.
	24. 918,287.	25. 614,853.	

ANSWERS.

EXERCISE XII.

1. 417,335.	2. 1,881,005.	3. 241,880.
4. 291,184,520.	5. 1,300,236,910.	6. 664,740.
7. 746,784.	8. 5,148,279.	9. 2,512,647.
10. 541,578,132.	11. 1,07,1246.	12. 4,635,213.
13. 6,273,432.	14. 8,281,174.	15. 69,124,407.
16. 57,360.	17. 254,220.	18. 824,040.
19. 407,280.	20. 64,450,950.	

EXERCISE XIII.

1. 445,705.	2. 669,606.	3. 1,146,585.
4. 8,464,224.	5. 920,992.	6. 1,459,710.
7. 11,789,177.	8. 6,262,906.	9. 533,722.
10. 106,629,345.	11. 1,668,560.	12. 11,922,882.
13. 10,371,924.	14. 17,253,330.	15. 2,914,314.
16. 4,839,492.	17. 2,069,430.	18. 15,802,464.
19. 13,927,641.	20. 16,347,096.	

EXERCISE XIV.

1. 58,044.	2. 168,268.	3. 263,548.
4. 1,896,792.	5. 33,002,403.	6. 29,481,614.
7. 64,490,742.	8. 77,624,092.	9. 20,638,023.
10. 25,279,818.	11. 31,317,481.	12. 32,654,841.
13. 36,285,057.	14. 30,040,739.	15. 30,479,085.
16. 24,010,259.	17. 2,302,083.	18. 250,034,307.
19. 303,056,748.	20. 463,679,913.	

EXERCISE XV.

1. 150,575.	2. 177,075.	3. 1,141,950.
4. 2,456,750.	5. 1,631,075.	6. 2,025,625.
7. 1,648,550.	8. 18,148,525.	9. 23,289,300.
10. 14,548,175.	11. 21,451,640.	12. 26,315,205.
13. 8,209,845.	14. 16,836,470.	15. 20,427,470.
16. 4,628,070.	17. 10,389,330.	18. 15,796,305.
19. 28,252,845.	20. 33,713,370.	21. 1,755,820.
22. 49,940,660.	23. 42,098,760.	24. 6.790,080.
25. 50,063,640.		

EXERCISE XVI.

1. 3,126,630.	2. 22,855,820.	3. 4,862,650.
4. 15,470,910.	5. 37,225,370.	6. 17,689,575.
7. 55,710,375.	8. 25,708,575.	9. 27,033,900.
10. 61,425,975.	11. 2,571,450.	12. 71,042,550.
13. 38,870,475.	14. 51,861,675.	15. 21,078,675.
16. 9,311,410.	17. 20,355,885.	18. 31,675,590.
19. 44,139,310.	20. 57,704,460.	21. 30,318,870.
22. 64,835,695.	23. 54,431;580.	24. 87,237,265.
25. 58,411,035.		

(To be continued.)

—o—

Quarterly Arithmetical Tests.

BY JOSEPH WOLLMAN,

Head Master of the Wellgate Board School, Rotherham.

STANDARD I.—FIRST QUARTER.

1. 45	2. 569	4. A butcher had 476 sheep, and he killed 234. How many had he left?
607	26	
92		
130	3. 748	
4	713	

SECOND QUARTER.

1. 573	2. 496	4. How many farthings shall I have left out of 50, if I spend three dozen?
19	157	
846		
5	3. 354	
298	280	

THIRD QUARTER.

1. 9	2. 803	4. One farmer had 37 cows, another 4 dozen, another 65, another 3 score, and another 78. How many had they altogether?
56	308	
3		
970	3. 672	
485	85	

STANDARD II.—FIRST QUARTER.

1. From 80,003 take 79,996.

2. 6 + 38 + 725 + 49,087 + 6,159 + 503 + 94 + 2.

3. 46,937 × 45.

4. A person borrowed one hundred pounds, and paid back 47 pounds and 39 pounds. How much does he still owe?

SECOND QUARTER.

1. What is the product of 60,953 and 706?

2. Divide 28,376 by four, and write the answer in words.

3. Take 987 from forty thousand.

4. How many sums are there in an arithmetic which contains 48 leaves, and has 29 sums on each page?

THIRD QUARTER.

1. Multiply 37,809 by 3,080.

2. Find the difference between 36,458 and 92,013.

3. How many times is 7 contained in 25,053?

4. James has 375 nuts and Thomas has 54 more. How many less than a thousand have they together?

STANDARD III.—FIRST QUARTER.

1. Divide 54,210 by 65.

2. How often is 780 contained in 506,220?

3. Divide the product of 2,964 and 407 by 39.

4. A tank containing 5,000 gallons of water supplies 98 houses. If each house requires 46 gallons, how many gallons of water remain in the tank?

SECOND QUARTER.

1. Add together £86 14s. 10½d., £709 13s. 9½d., £950 8s. 7¾d., £64 19s. 11¼d., and £7 16s. 5½d.

2. What is the remainder when half a million is divided by 678?

3. Take seven pounds and ten pence three farthings from seventy pounds sixteen shillings and a farthing.

4. Fred has 15s. 9d., and Harry has 3s. 10d. less than Fred. How much have they together?

THIRD QUARTER.

1. Find the difference between £70,609 13s. 7¾d. and £80,504 10s. 6½d.

2. Multiply the quotient of 359,784 and 456 by 780.

3. £965 18s. 3½d. + £8,049 19s. 7½d. + £17 15s. 10d. + £29,706 4s. 9½d. + £63,495 17s. 11¼d. + £7,580 6s. 8¾d.

4. A horse was sold for £39 15s. 9d. What did it cost the dealer if he gained £7 16s. 6d.?

STANDARD IV.—FIRST QUARTER.

1. Divide £794 13s. 6½d. by 856.

2. What must be paid for 709 pounds of cheese at 9½d. per pound?

3. What is the difference in price between a yard of silk and a yard of velvet, if 158 yds. of silk cost £86 4s. 10d., and 76 yds. of velvet cost £46 11s.?

4. What is the rent of a house for three years at 5s. 9d. a week?

SECOND QUARTER.

1. Reduce 5¾ miles to inches.

2. How many horses worth £35 17s. each can be bought for £5,449 4s.?

3. How many square yards are there in 2¼ square miles?

4. A grocer bought 3 cwt. of sugar at 1¾d. per lb., and sold it at 2¼d. per lb. What was his profit?

THIRD QUARTER.

1. Lodgings at 3 guineas a week are occupied for 2 months 2 weeks 2 days. How much must be paid for them?

2. How many pints of ale will be required to fill 6,739 nine-gallon casks?

3. How many yards of velvet at 2s. 9d. a yard can I get in exchange for 11 yards of silk at 6s. 9d. a yard?

4. What is the cost of 17 tons 18 cwt. of coals at 1s. 2½d. per cwt.?

STANDARD V.—FIRST QUARTER.

1. What is the cost of 47 yds. 1 ft. 10 in. at 7s. 10½d. a yard?

2. A bankrupt owes £3,794, and he can pay 15s. 8d. in the pound. What is the value of his assets, and what do the creditors lose?

3. Find the value of 23 loads 5 bus. 3 pks. at 32s. 8d. per quarter.

4. What is the value of twenty thousand and seventy acres at £58 17s. 2½d. per acre?

SECOND QUARTER.

1. If 19½ lbs. of coffee cost £1 10s. 10½d., what will 27¼ lbs. cost?

2. Find the value of 17 tons 1,950 lbs. at £16 6s. 8d. per ton.

3. A journey of 88 miles takes from 9.5 a.m. to 11.50 a.m. How far can you travel in 6 hours at this rate?

4. Bill:—

5 barrels of ale at 1s. 8d. per gal.;
3 barrels of beer at 1s. 6d. per gal.;
7 barrels of porter at 1s. 5d. per gal.;
9 dozen bottles of port at 3s. 9d. per bottle;
6½ dozen bottles of sherry at 2s. 10d. per bottle.

THIRD QUARTER.

1. Add $\frac{7}{8}$ to the difference between $\frac{4}{9}$ and $\frac{5}{6}$.

2. From the greater of $\frac{7}{9}$ and $\frac{5}{7}$ take $\frac{3}{10}$.

3. If 7½ cwt. be carried 200 miles for 15s. 6d., how many lbs. will be carried 32 miles for the same money?

4. In the following fractions four of them are of the same value; pick them out, and add them together:—$\frac{3}{8}$, $\frac{3}{15}$, $\frac{6}{8}$, $\frac{4}{20}$, $\frac{7}{35}$, $\frac{4}{16}$, and $\frac{5}{25}$.

STANDARD VI.—FIRST QUARTER.

1. Divide 300 into two parts, so that one shall exceed the other by 19·367.

2. If $\frac{3}{7}$ of $\frac{5}{9}$ of $1\frac{1}{3}$ of a number is 12, what is the number?

3. Multiply ·3456 by ·9$\dot{8}\dot{7}$.

4. Simplify—

$$\frac{1\frac{7}{8} \text{ of } 3\frac{6}{7} - \frac{5}{6}}{1\frac{11}{14} \text{ of } 2\frac{2}{3} + \frac{5}{8}}.$$

SECOND QUARTER.

1. What decimal of 2¼ acres is $\frac{5}{7}$ of 3 ro. 6 po.?

2. If a man walks 6¼ miles in 1¾ hours, how long will it take him to walk 37½ miles at the same rate?

3. Find the value of 9·3 $\dot{5}\dot{8}\dot{3}$ florins + 6·325 crowns − 13·741$\dot{6}$ half-crowns.

4. A sets out in a carriage at the rate of 9 miles an hour. In three-quarters of an hour B follows at the rate of 11 miles an hour. In what time will B overtake A?

THIRD QUARTER.

1. What is the interest on £1,167 16s. 8d. for 37 weeks at 2½ per cent.?

2. A sugar-dealer, by selling sugar at £1 7s. 9d. per cwt. which cost £1 3s. 6d. per cwt., gained £4 0s. 9d. What quantity did he sell?

3. If I get an income of £97 10s. by investing money at 4 per cent., what amount have I invested?

4. An army lost ·24 of its number in battle and ·18 by disease. The number left was 109,736; what was the original number of men?

STANDARD VII.—FIRST QUARTER.

1. What sum of money must be put out at simple interest at 4⅛ per cent. to amount to £791 13s. 4d. in 8 years?

2. If 6 men or 10 boys can dig a ditch in 12 days of 8 hours each, how long will it take 9 men and 9 boys working 7½ hours a day?

3. What amount is the same fraction of 5s. 3d. as $\frac{3}{5}$ of £2½ is of 2½ guineas?

4. If it cost £348 to supply a garrison of 240 with provisions for 15 days, when the rations are 36 oz. per day, what will it cost to supply 350 men with provisions for 27 days, when rations are 2½ lbs. per day?

SECOND QUARTER.

1. A person borrows £500 at the rate of 4 per cent. per annum, and repays it in four equal quarterly instalments with proportionate interest. Find the total amount of interest.

2. The average age of 20 girls is 13½ years; the oldest is 15 years and the youngest 9 years. Find the average age of the rest.

3. How long will it take £476 5s. to amount to £592 18s. 7½d. at 3½ per cent.?

4. A workman was paid 6½d. per hour. One week he worked 6 days, averaging 9 hours a day; the next he worked 5½ days, averaging 10 hours a day; the next 5¾ days, averaging 8 hours a day; and the next 6 days, averaging 9½ hours a day. What was the amount of his average weekly wages for the month?

THIRD QUARTER.

1. A person sold a watch for £6, and gained one-third of the cost. Find the cost price and the gain per cent.

2. A sells an article to B at a gain of 10 per cent. B sells it to C for 20s. 2d., and also gains 10 per cent. What did A give for it?

3. A man can do a piece of work in 8 days, and a boy can do it in 15 days. The man works at it alone for 3 days, and is then assisted by the boy. In what time will the work be completed?

4. For what sum must I ensure a house worth £2,397 at 2s. 6d. per cent., so that in case of fire I may recover the value of the house and the premium?

ANSWERS.

STANDARD I.

	FIRST.	SECOND.	THIRD.
1.	878.	1,741.	1,523.
2.	543.	339.	495.
3.	35.	74.	587.
4.	242 sheep.	14 farthings.	288 cows.

STANDARD II.

	FIRST.	SECOND.	THIRD.
1.	7.	43,032,818.	116,451,720.
2.	56,614.	7,094.	55,555.
3.	2,112,165.	39,013.	3,579 times.
4.	14 pounds.	2,784 sums.	196 nuts.

STANDARD III.

	FIRST.	SECOND.	THIRD.
1.	834.	£1,819 13s. 8¾d.	£9,894 16s. 10¾d.
2.	649 times.	314.	615,420.
3.	30,932.	£63 15s. 1½d.	£109,816 3s. 2½d.
4.	492 gallons.	£1 7s. 8d.	£31 19s. 3d.

STANDARD IV.

	FIRST.	SECOND.
1.	18s. 6¾d. + 194q.	364,320 inches.
2.	£28 1s. 3½d.	152 horses.
3.	1s. 4d.	6,969,600 horses.
4.	£44 17s.	£1 1s.

THIRD.

1. £32 8s.
2. 485,208 pints.
3. 27 yards.
4. £21 12s. 7d.

STANDARD V.—FIRST.

1. £18 14s. 11¼d.
2. £2,971 19s. 4d. and £822 0s. 8d.
3. £189 0s. 1½d.
4. £1,181,328 11s. 3d.

SECOND.

1. £2 3s. 1¾d.
2. £291 17s. 8½d.
3. 192 miles.
4. £15 + £8 2s. + £17 17s. + £20 5s. + £11 1s. = £72 5s.

THIRD.

1. 1⅛.
2. ⅛.
3. 5,250 lbs.
4. ⅞.

STANDARD VI.

	FIRST.	SECOND.	THIRD.
1.	159·6835 and 140·3165.	·25.	£20 15s. 5¾d.
2.	90.	10½ hours.	19 cwt.
3.	·375552.	16s. 0¾d.	£2,437 10s.
4.	1⅛.	3 hrs. 22½ min.	189,200 men.

STANDARD VII.

	FIRST.	SECOND.	THIRD.
1.	£593 15s.	£12 10s.	£4 10s. and 33⅓%
2.	5½ days.	13¾ years.	16s. 8d.
3.	3s.	7 years.	6⅔ days.
4.	£1,015.	£1 8s. 8½d.	£2,400.

An Elementary Course in the Use of Wood Working Tools.

BY FRED. WILKINSON, F.G.S.,

Science Teacher under the Bolton School Board.

IN our last we briefly referred to the jack plane. We propose in this number to deal more fully with it.

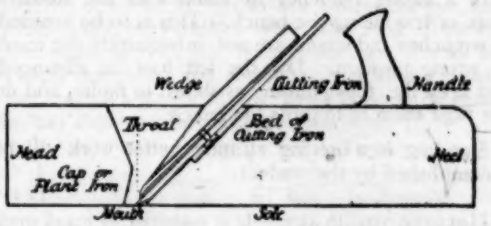


Fig. 12.

The whole plane, we repeat, is made up of the stock, the cutting tool or iron, the cap or plane iron, and the wedge.

THE STOCK.—This is usually made of hard wood (beech, which has a density of ·852). Sometimes however the stock of the plane is made of iron, but as this is used for special purposes, and does not form part of our course we, dismiss it with this slight reference.

The sole or face of the plane (fig. 12) should be perfectly smooth. In applying it to the wood the greatest care is required to keep this face flat upon the planed surface. Unless this is done quite a variety of irregularities is the result. We shall point these out a little later on. Now suppose the block of wood

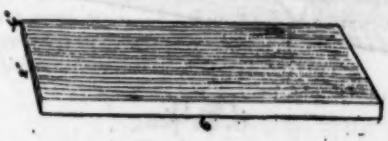


Fig. 4.

(fig. 4) requires the face which is shaded in diagram to be made perfectly true or flat.

A few important points must be noticed by the pupil before he commences to use the plane.

1. Position of body with regard to bench.
2. Holding the plane in a proper manner.
3. Horizontality of plane an absolute necessity.

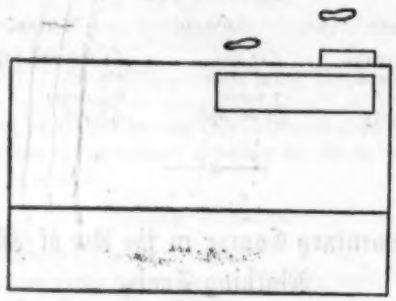


Fig. 13.

POSITION OF BODY.—Let fig. 13 represent the plan of the bench with the wood ready for planing fixed in position. The feet should be almost parallel with bench, as shown in the diagram. The right side of the body should be near the bench. Students at first have a strong tendency to stand with the stomach more or less facing the bench. This is to be avoided, as wrenches and strains are not infrequently the result of wrong position. Let the left foot be advanced, and keep the toes pointing as shown in figure, and do not twist them in towards the bench.

Standing in a bracing attitude better work will be accomplished by the student.

HOLDING THE PLANE.—It is essential to good work to hold the plane in the proper manner. Grasp the handle firmly in the right hand and allow the first finger to rest on the cutting iron or wedge. With regard to the left hand there is a universal disposition to place the thumb of the left hand on the wrong side of the plane. It should not be placed on the *right* side of the plane but on the *left*, and the four fingers of the same hand should be on the right side of the plane. The palm will be directly over the top of the plane as shown in fig. 14.

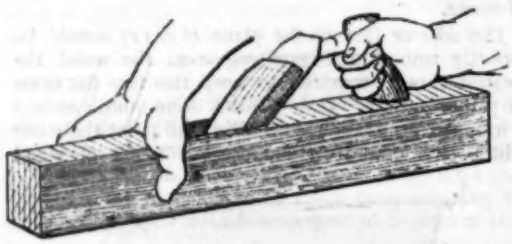


Fig. 14.

If the thumb be placed on the right of the plane, the elbow is brought in contact with the body in withdrawing plane, and freedom of action with the plane is seriously interfered with.

Held in the proper manner it may be sent forward and withdrawn without the slightest inconvenience. If the surface to be planed be a good length it is advisable to commence at the right hand, rear end, and plane across to left hand, rear end. Then step forward and plane another portion across as before.

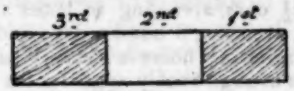


Fig. 16.

In commencing to plane a piece of wood it is very important that the plane should be held perfectly horizontal at the start.

Let us see what may happen unless this is attended to.

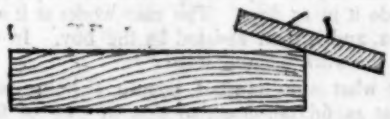


Fig. 15.

Suppose we are planing a block and we do not hold the plane horizontally but at an angle, as shown in diagram 15. The result is that end is tapered, and very often splintering accompanies this form of holding the plane.

Applying pressure to head of plane by left hand, and keeping it horizontal, push the plane forward by the right hand. A much better result is now obtained. Again, if we regard diagram 17 as the end sections of block being planed we can see what may happen when we apply more pressure on right side of plane than is exerted on left and *vice versa*.

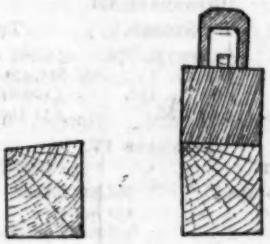


Fig. 17.

In planing narrow strips or the edges of boards it is well to place two or three fingers below the plane on the sole, with the thumb on the top, maintaining all the time of planing gentle pressure, so as to keep the plane in contact with the wood. Whatever tends to dull the tool should be avoided carefully. Sometimes beginning to plane a piece of wood which has not been properly cleaned, and which contains grit, is a source of mischief. Then, again, in withdrawing the plane the cutting edge should not be drawn back on the wood. This may be avoided by tipping the plane up at the heel and withdrawing it on the toe, or the

toe may be tipped and the plane withdrawn on the heel. It not infrequently happens that the tool refuses to cut. We find the mouth choked up with shavings, &c. Clean the mouth first, and if the same thing occurs again shortly after, sharpen up the tool on the stone. (This should, at present, be done by the teacher.) Clogging is frequently caused by the tool being dull.

A narrow mouth, too, allows itself to be soon clogged, but as a narrow mouth is an essential to the production of smooth surfaces it is well to keep a sharp eye on the cutting edge and put up with a narrow mouth.

Exercise IX.

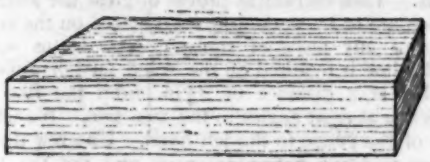


Fig. 18.

We next proceed to show how a surface may be trued. Suppose we are required to produce a perfectly smooth surface on block AB, fig. 18.

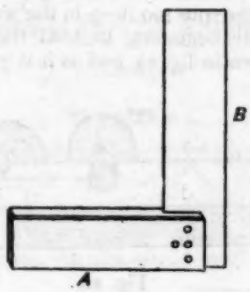


Fig. 19.

We clean one side or face first from dirt and grit. Take the plane in the hand, as previously directed, and proceed to plane the surface. Now, having used it for some time, it will be necessary to test the work done, and see if it be correct. How can we do this? It may be tested by using what is known as a *Try square*, or set square. Fig. 19 shows one.

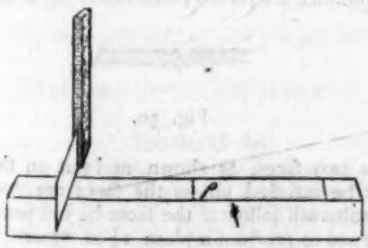


Fig. 20.

FOURTH TOOL: TRY SQUARE.—It consists of a wooden beam, A, generally of hard wood, faced with a brass edge on the inside, and a blade of steel B, fixed at right angles to A. If the wood be planed sufficiently true it will be readily seen when we place the blade on the planed surface, as shown in diagram 20. Next test the worked face in the middle, and then at the end, as shown by dotted lines. (Fig. 20.)

This trial may be satisfactory, but it is necessary for beginners to try another method.

We next apply what are known as winding sticks. These are two strips of wood about 2 in. × 12 in. × $\frac{3}{8}$ in. One edge on each is bevelled, and one side of one of them is painted black.

Take the twisters, as they are sometimes called, and put them on the planed face, as shown in diagram 21.

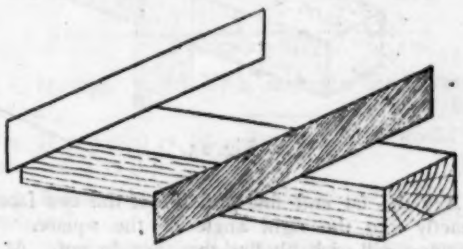


Fig. 21.

Place the one with the black side nearer the eye, and the black side opposite the eye. Now look along the upper edges of both the twisters and see if they are perfectly horizontal and parallel. If not, the surface is not true. A glance at the two following diagrams (fig. 22) shows a true and untrue surface.

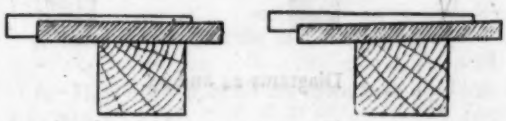


Fig. 22.

In time, and by practice, the student will be able to tell almost true faces by taking the wood in both hands. Holding the surface of the piece obliquely from him, and glancing the eyes along the planed surface, if the two edges be parallel it may be taken to be fairly true.

Having now obtained a true face we now give it a name, and in future distinguish it by that name. This face plays an important part in all future operations, and upon the 'trueness' of the '*Face side*,' as it is called, depends good or bad work. In order that we may readily recognise this face we must give it a mark. Any kind will do, but when we have decided upon one we must keep to it. Our face side mark will be ρ. The line from the loop should always run to the edge. (See diagram 20.)

Exercise X.

Our next Exercise will be the production of a face at right angles to our finished or first face. The use of the 'Try square' will be involved in this Exercise.

We plane a second face as before, and when we think it is true we proceed to try it in the following way:—Take the piece of wood in the left hand and apply the beam of the square, which is held lightly in the right hand, to the face side marked ρ, and bring the blade on the top of the face we are working, as shown in diagram 23.

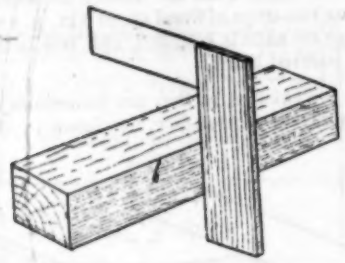
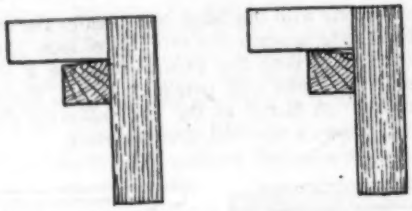


Fig. 23.

Try the far end first and see if the two faces fit exactly into the right angle of the square. The beginner will probably find that they do not. At first he may find the top surface as in diagram 24 or 25.



Diagrams 24 and 25.

The student will at once see which edge is up or down, and remedy the defect by applying the jack plane. As we marked the 'face side' so must we provide a mark for this second trued surface or 'face edge' as it is called. In future operations we shall mark the face edge thus ⊤, making the stroke run as before to the edge. (See diagram 20.)

We have now trued two faces, and are in a fair way for working the Exercise known as 'Squaring timber.'

FIFTH TOOL: MARKING GAUGE.—Though simple in construction this tool is exceedingly useful and reliable.

Fig. 26.

Fig. 27.

Fig. 26 shows a single marking gauge or marker. Its parts are—(*a*) the stock or head; (*b*) the spur, this is magnified in fig. 27; (*c*) the bar or handle; (*d*) screw to fix head in any position on the bar. The handle in the common gauge is about nine inches in length.

Figure 28 shows the gauge in end elevation.

Fig. 28.

Some gauges have the inches marked on the stem, but as a rule these are not reliable. It is better to get one plain, as the measurements made by rule are safer. This instrument proves of great use when lines which are to be worked to are required on the working face of any piece of timber. Now let us suppose that a line is required on the trued face of a piece of timber at a distance of 2¼ in. from the face edge, which is at right angles to the face side. We take the bar of the gauge in the left hand. Unscrew the head so as to leave it free to move, and put the thumb against the head. Take a rule in the right hand and put it against the head, on the side remote from the thumb. Now push the head along until the distance between the spur and the head is exactly 2¼ in. Now screw up and the gauge is ready for use.

Apply the head to the face edge, taking great care not to push the spur too deep in the wood at first. It is better when beginning to hold the gauge in the position shown in fig. 29, and as it is gradually pushed

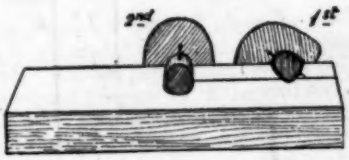


Fig. 29.

along to bring it horizontal and allow the spur then to work to its true depth. Hold the wood in the left hand and a little aslant. To prevent it slipping put the bench stop on the bench and put the wood being gauged on it.

Exercise XI.

To produce a squared piece of timber of any width.

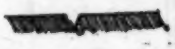


Fig. 30.

True two faces, as shown, and put on the marks. Do not be satisfied unless the faces are accurate, as bad results will follow if the faces be but poorly trued. Say we are to produce a piece 1½ in. square. Set the gauge to 1½ in., and run two gauge lines on the timber, one on the *face side* (gauge from the face edge), and another on the side opposite. Let us now see the nature of the mark made by spur of gauge. Fig. 30 shows an enlarged view of what the spur has really done.

We find a V-like impression made in the wood. The apex of the V is exactly in this case 1½ in. from the face edge, and in planing we must work down to the middle of this impression on both sides of the timber.

Fig. 31.

Fig. 31 shows the wood which must be planed away in order to get three sides square.

Now gauge two lines, one on the face edge this time, and on one side opposite.

In this case gauge from the face side, *i.e.*, put head of the gauge in each case on the face side.

Having gauged again, the plane takes the remaining portion off, as shown, and the timber is 'squared.'

(To be continued.)

—o—

Tests in Mental Arithmetic.

STANDARD I.

1. How many are 28 nuts and 65 nuts? 93.
2. How many is that short of 100? 7.
3. A boy had 12 marbles. He lost 8, and then bought 10. How many had he? 14.
4. How many marbles would you get for 3½d. at 20 a penny? 70.
5. How much would 100 marbles cost? 5d.
6. What is the cost of 1½ lbs. of soap at 6d. a lb.? 9d.
7. What would ¼ lb. cost? 1½d.
8. If a cow is worth 6 sheep, how many cows would a farmer get for 30 sheep? 5.
9. If a sheep is worth £3, what is a cow worth? £18.
10. If a cow was worth £24, what would be the value of a sheep? £4.
11. How many shillings could you get for £4? 80.
12. How many sixpences could you get? 160.

STANDARD II.

1. A girl had 2½d., and her brother had twice as much. How much had they together? 7½d.
2. How much is that short of a florin? 1s. 4½d.
3. How many halfpennies could you get for that sum? 33.
4. How many must you add to 33 to make half-a-hundred? 17.
5. I have 12 bags of marbles and 10 in each bag. To how many boys could I give 8 each? 15.
6. To how many could I give 20 each? 6.
7. A boy was sent to change half-a-crown, and brought back 3 sixpences, 3 threepenny pieces, and 4 halfpennies. How much was he short? 1d.
8. A boy is 4 ft. 7 in. in height. How many inches does he measure? 55.
9. How many more inches than a yard is that? 19.
10. What change would you get out of a shilling after buying ½ lb. of butter at 1s. 5d. a lb.? 3½d.
11. What is the cost of a gallon of milk at 2d. a pint? 1s. 4d.
12. How much could you get for 7d.? 3½ pints.

STANDARD III.

1. Multiply 3s. 6d. by 2, and give the answer in pence. 84.
2. If you earn 1s. 6d. a day, how much would you earn in 6 days? 9s.
3. A boy is 9 years old in April, 1890; when was he born? April, 1881.
4. When will he be 21 years old? April, 1902.
5. What would 5 boys' suits cost at 12s. each? £3.
6. If they had cost £4, what would have been the price of each suit? 16s.
7. Divide half-a-crown among 5 boys and 7 girls, giving each the same amount. What does each one get? 2½d.
8. If 50 eggs cost 4s. 2d., how much will 39 cost? 3s. 3d.
9. How many inches are there in half-a-yard? 18.
10. How many minutes are there from 2.30 p.m. to 4.15 p.m.? 105.
11. How many bags of coal, each holding a cwt., can be filled from a truck holding 4½ tons? 90.
12. If a ton cost 10s., what would a cwt. cost? 6d.

STANDARD IV.

1. Add ¼ and ⅓ of half-a-crown. 1s. 1½d.
2. What part of a florin is ⅓ of 6d.? 1/12.
3. A boy after spending three-quarters of his money had 3d. left. How much had he at first? 1s.
4. If he had 3d. left after spending one-fourth, how much had he at first? 4d.
5. If a clock loses 5 minutes daily, and is set right at 12 o'clock, what time will it show a week after? 25 min. past 11.
6. If a train travel 1 furlong in 15 seconds, at what rate per hour is it travelling? 30 miles.
7. How long would it take to go 5 miles at this rate? 10 minutes.
8. How far would it go in 3 hours 40 minutes? 110 miles.
9. What is the area of a ceiling in square yards, which is 24 feet long and 18 feet wide? 48.

10. What would it cost painting at 9d. a square yard? £1 16s.

11. If 7 men can do some work in 15 days, how long would it take 21 men? 5 days.

12. If the work was done in one day, how many men must have been working? 105.

STANDARD V.

1. What is $\frac{1}{4}$ of $\frac{1}{2}$? $\frac{1}{8}$.

2. How much is $\frac{1}{8}$ of a crown? $7\frac{1}{2}$d.

3. What part of a crown is $3\frac{3}{4}$d.? $\frac{1}{16}$.

4. What is the value of 650 eggs at 5s. a hundred? £1 12s. 6d.

5. If rice is bought at 9s. 4d. per cwt., and sold at 14s. per cwt., what is gained on a lb.? $\frac{1}{2}$d.

6. A boy, whose age is 12, is $\frac{2}{7}$ the age of his father. How old is the father? 42 years.

7. If the father is 40 years old, what fraction would the son's age be? $\frac{3}{10}$.

8. If £40 is lent for a year for a payment of £6, how much should be paid for a loan of £100? £15.

9. What is the interest on £150 for $1\frac{1}{2}$ years at 4 per cent.? £9.

10. If the interest had been £21, how long would it have been invested? $3\frac{1}{2}$ years.

11. What vulgar fraction is equal to ·4? $\frac{2}{5}$.

12. What is ·4 of a sovereign? 8s.

STANDARDS VI. AND VII.

1. In what time will £300 double itself at $4\frac{1}{2}$ per cent. simple interest? $22\frac{2}{9}$ years.

2. If the time had been $28\frac{4}{7}$ years, what would have been the rate per cent.? $3\frac{1}{2}$ per cent.

3. After paying away $\frac{3}{4}$ of $\frac{4}{5}$ of my money I had 3s. 6d. left. How much had I at first? 7s. 6d.

4. If I had 12s. 6d. at first, how much should I have had left? 5s. 10d.

5. What is the difference between $\dot{8}$ and ·8 of £45? £4.

6. Express the difference between the two decimals as a vulgar fraction. $\frac{4}{225}$.

7. A man running 5 miles an hour starts after a boy running 3 miles an hour, who has had one hour's start. When will the man overtake the boy? $1\frac{1}{2}$ hours.

8. If the man had been going $4\frac{1}{2}$ miles an hour, in what time would he catch him? 2 hours.

9. What percentage of 20 is ·6? 3 per cent.

10. What is 6 per cent. of ·27? ·0162.

11. The cost price of a book is 5s. If the expense of sale is 12 per cent. and the profit 18 per cent., what is the selling price? 6s. 6d.

12. If the selling price were 7s. 6d., the profit 13 per cent., and the expense of sale the same, what would have been the cost price? 6s.

How my School was Examined.

BY THE HEAD MASTER OF A COUNTRY SCHOOL.

STANDARD I.

Arithmetic.—Three sets of sums were given as follows:—

A. 1. 64 + 714 + 601 + 18 + 30.
2. From 600 take 591.
3. Take 490 from 708.

B. 1. 38 + 174 + 90 + 409 + 8.
2. Take 75 from 608.
3. From 901 take 398.

C. 1. 904 + 8 + 16 + 700 + 43.
2. From 900 take 18.
3. Take 92 from 104.

Answers.—*A.* (1) 1,427; (2) 9; (3) 218.
B. (1) 719; (2) 533; (3) 503.
C. (1) 1,671; (2) 882; (3) 12.

Mental Arithmetic.—The following questions were asked:—

4 time 9? 7 times 2? 5 times 4? 6 times 8? 3 times 9? Twice 11? 5 nines? 5 eights? 6 fours? 3 times 7? 4 times 7? 5 times 7? 4 eights? Take 10d. from 1s. How many halfpenny buns should I buy for 6d? For 8d.? For 10d? How many halfpennies in $7\frac{1}{2}$? Add 6, 4, 3, 2. Take 7 and 4 from 13. If I had 16 apples and 9 were bad, how many were good? I have 20 black and white marbles, 12 are black, how many are white? If marbles are 8-a-penny, how many can I get for 6d.? for 7d.? for 8d.? for 1s.?

Writing.—Ten words were dictated:—*Fields, Skins, Piece, Heavy, Money, Earth, Paper, Donkey, Food, People.*

STANDARD II.

Arithmetic.—Three sets of sums were given:—

A. 1. 9,461 × 607.
2. 50,491 − 9,008.
3. 74,621 ÷ 7.
4. In a certain school there are 404 children, 264 are boys, how many are girls.

B. 1. Multiply 3,061 by 6,900.
2. From 70,600 take 908.
3. Divide 54,132 by 9.
4. Out of a basket containing 400 apples I take 17 dozen, how many are left?

C. 1. Multiply 40,621 by 71.
2. Take 9,040 from 30,901.
3. Divide 41,916 by 11.
4. In a street there are 216 houses, how many houses are there in 14 such streets?

Answers.—*A.* (1) 5,742,827. (2) 41,483. (3) 10,660 + 1. (4) 140 girls.

B. (1) 21,120,900. (2) 69,692. (3) 6,014 + 6. (4) 196 apples.

C. (1) 2,884,091. (2) 21,861. (3) 3,810 + 6. (4) 3,024 houses.

Mental Arithmetic.—Add 6, 7, 4, 3, 9. Add 2, 1, 9, 12, 13. Add 4, 6, 19, 7, 2. Add 15, 12, 16, 8. Take 19 from 28. Take 15 from 22. 17 from 33. 19 from 25. Twelve fours. 9 eights. 7 sevens. 8 nines. 7 eights. 8 sevens. Take 4 fours from 5 fours. 3 nines from 30. 35 from 7 eights. Add 9 nines to 12 twos.

How many pence in 6s. 8d.? in 7s. 4d.? in 5s. 8d.? in 9s. 4d.? in 11s. 7d.? in 8s. 3d.? in 7s. 7d.?

How many shillings in 104d.? in 62d.? in 94d.? in 50d.? in 131d.? in 81d.? in 75d.?

Take 1s. 8d. from 2s. Half a pound of tea at 2s. 8d. per lb. What change out of half-a-crown? How much is a crown? How many crowns in a sovereign? How many half-crowns? 4 lbs. of sugar at 2½d. per lb. What change out of 2s.? 28 books at ¼d. each? How many times 1½d. in 2s.? How many times 6d. in 8s. 6d.?

Writing.—The following passage was dictated from one of the reading books:—

'It is sad, indeed, but I hope it does not very often happen. Whole families—men, women, and children—live down in the mines; many are born there, and never stir out—never see daylight, or the beautiful fields and trees.'

Grammar.—The scholars were required to pick out nouns and verbs from a passage in the reading book. The following oral questions were asked:—What is a noun? What is a proper noun? What kind of noun is 'George'? Can you see a noun? What do I mean by a collective noun? Tell me what a verb is.

STANDARD III.

Arithmetic.—Specimen cards:—

A. 1. Divide 7,461,900 by 617.

2. From £6,001 19s. 4½d. take £3,901 16s. 9d.

3. Add together £9,014 17s. 4½d.; £914; £906 16s. 4½d.; £7 14s. 11d.; £2,191 14s. 8d.; £38 18s. 11¾d.

4. A woman went to market with £4 19s. 8½d. She spent the butcher's 16s. 9d.; at the grocer's £1 14s. 3d.; and at the draper's £1 1s. 6½d. How much did she take home?

B. 1. Divide 9,463,218 by 91.

2. Take £96 4s. 7¾d. from £1,000 10s. 2d.

3. Add £74 19s. 2½d.; £916 18s. 4¾d.; £2,091 0s. 4d.; £1 19s. 11¾d.; 16s.; £40 0s. 1½d.

4. What is the amount of 3 crowns + 5 half-crowns + 9 florins + 12 shillings + 5 threepences + 11 twopences?

Answers.—*A.* (1) 12,093 + 519. (2) £2,100 2s. 7½d. (3) £13,074 2s. 3½d. (4) £1 7s. 2d.

B. (1) 103,991 + 37. (2) £904 5s. 6½d. (3) £3,125 14s. 0½d. (4) £3 0s. 7d.

Writing.—The following passage was dictated from the reading book:—

'When it rains, as we have seen, it rains all over the country for many miles, sometimes all over England at once. But all the country is not flat like a yard. Some of you live in a part where there are hills and mountains standing up out of the ground like hugh houses or factories, with their tops reaching up into the clouds.'

Grammar.—Oral questions were asked on the noun, the verb, the adjective, the pronoun, and the adverb, the principal ones being on the personal pronouns. The children were required to select nouns, verbs, adjectives, pronouns, and adverbs, especially the latter, from the reading book.

STANDARD IV.

Arithmetic.—Specimen cards:—

A. 1. Multiply £64 17s. 1½d. by 85.

2. Divide £30,618 17s. 0¾d. by 219.

3. How many feet are there in 64 miles, 6 furlongs, 22 poles, 3 yards.

4. If a wheel is 3 ft. in circumference, how many times does it turn round in a journey of six miles?

B. 1. Multiply £9 18s. 6¾d. by 219.

2. Divide £694 17s. 9¼d. by the half of 168.

3. How many times can a quart cup be filled from a sack containing three bushels of corn?

4. How much time does a boy waste in three years, if he wastes 3 minutes every hour for 5 hours a day and 5 days a week? Give the answer in hours.

Answers.—*A.* (1) £5,512 15s. 7½d. (2) £139 16s. 2¾d. + 138. (3) 342,252 ft. (4) 10,560 times. *B.* (1) £2,273 10s. 9¾d. (2) £8 5s. 5¼d. + 49. (3) 96 times. (4) 195 hours.

Writing.—The following paragraph was given for dictation:—

'The chambers which looked upon the garden were bright and pleasant, and immediately below the windows the garden sloped gently away, shaded with the massy foliage of the fig, or the feathery boughs of the almond, and breathing perfume from the tall orange-trees. The garden was easily reached from the western gallery by an inclined path constructed to save the gouty monarch the fatigue of going up and down stairs.'

Grammar.—Four different sentences were set for parsing:—

A. He ran down the hill.

B. She sang the song well.

C. The poor old man died suddenly.

D. A hawk attacked a small bird.

Then oral questions were asked as follows:—How many kinds of pronouns are there? Give one of each kind. Make sentences containing one of each kind. What is the gender of *husband?* Give its feminine. Give the feminine gender to *brother, horse, bull, man.* What is a conjunction? How many kinds are there? Make a sentence containing a conjunction, an interjection, an adverb, a preposition. What do we mean by case? How many ways can a noun be in the objective case? Give an example of each. Make a sentence containing a noun in the possessive case.

STANDARD V.

Arithmetic.—Specimen cards.

A. (1) Find the cost of 4,960 articles at £4 18s. 7½d. each.

2. Find the value of $\frac{3}{5} + \frac{1}{6} + \frac{5}{7} + 1\frac{1}{2} - 1\frac{1}{2}$.

3. Make out and receipt a bill for 8 loaves at 6½d. each, 4 lbs. of sugar at 2¾d. per lb., 10 lbs. of coffee at 1/10 per lb., 11½ lbs. of tea at 2/8 per lb.

4. If 12 men can do a piece of work in 160 days, how many more men must be employed to finish it in 120 days?

B. 1. Find the cost of 4 tons 17 cwt. 3 qrs. at £2 6s. per ton.

2. Add together $\frac{3}{4}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{7}{8}$, and $1\frac{1}{12}$.

3. Make out and receipt a bill for the following:—
2 silk umbrellas at 12s. 6d. each.
30 pairs of gloves at 2s. 8d. per pair.
24 yards of calico at $3\frac{1}{2}$d. per yard.
14 yards of lawn at 3s. 6d. per yard.
60 silk handkerchiefs at £2 8s. per dozen.

4. A debtor owes £2,400, his assets are £400. How much do his creditors loose per pound?

Answers.—*A.* (1) £24,459. (2) $\frac{3}{16}$. (8) 4s. 4d. + 11d. + 18s. 4d + £1 10s. 8d. = £2 14s. 3d. (4) 4 men.

B (1) £11 4s. $9\frac{3}{4}$d. + $\frac{3}{8}$. (2) $3\frac{7}{8}$. (3) £1 5s. + £4 + 7s. 6d. + £2 9s. + £7 = £15 1s. 6d. (4) 16s. 8d.

Writing.—A story was read out twice and then the scholars were required to reproduce it.

Grammar.—The following exercises were set in parsing and analysis:—Parse 'Sometimes men's thoughts are taken up with avarice and ambition.'

Analyse ''Tis the mind that makes the body rich.'
'He sinned, and, moreover, denied his fault.'

Oral questions such as the following were asked.—What is mood? How is the passive voice formed? What is the subjunctive mood?

STANDARD VI.

Arithmetic.—Specimen cards.

A. 1. A could do a piece of work in 6 days, B in 8 days, and C in 10 days. How long would it take them to do it working together?

2. $\frac{1}{4}$ of $\frac{1}{8}$ of 7 $\frac{3}{10} \div \frac{3}{4}$ of $1\frac{3}{5}$ of $6\frac{1}{4}$.

3. Find the value of $4\frac{1}{3}$ shillings + $2\frac{1}{7}$ of 1s. 9d. + $4\frac{1}{2}$ of 1 guinea + $3\frac{3}{5}$ of a crown − £3 7s. $1\frac{3}{5}$d.

4. A woman went to market with £7 14s. 9d., she spent $\frac{4}{5}$ of $\frac{5}{6}$ of the sum at one shop, and $\frac{1}{3}$ at another. What had she left?

B. 1. Simplify $\frac{\frac{4}{5} \text{ of } \frac{5}{6} \text{ of } \frac{6}{7}}{\frac{3}{4} \text{ of } 1\frac{1}{3} - \frac{1}{2}}$

2. Add 74·613; 8·0061; 41·008; 3·00901; 171·45; 62·994.

3. A pipe discharges 3 pints 2 gills of water in one minute. How long will it take to empty a cistern containing 280 gallons?

4. What sum will amount to £441 in two years at 5 per cent, compound interest?

Answers.—*A.* (1) $2\frac{2}{11}$ days. (2) $\frac{12}{1000}$. (3) £2 7s. $11\frac{1}{2}$d. (4) £1 5s. $9\frac{1}{2}$d.
B. (1) $\frac{2}{35}$. (2) 361·08011. (3) 10 hrs. 40 min. (4) £400.

Composition.—Write about the *Post Office.*

STANDARD VII.

Arithmetic.—Specimen cards.

A. 1. If 7 persons earn £21 6s. in 10 days, how much will 28 persons earn in 15 days?

2. The price of a house was lowered from £450 to £360 15s., how much per cent was it lowered?

3. A man, a woman, and a child earned £1 17s 6d. in one week. The man earned twice as much as the woman, and the woman three timesas much as the child. Find what each of them would earn in six weeks

4. A merchant sells a quantity of corn at 46/- per quarter. The purchaser on selling again at a rise of 3s. a quarter, realises £18 by the transaction. How many quarters were sold?

B. 1. If 200 men can make an embankment 150 yards long, 25 feet wide, and 6 feet high in 5 days, working 12 hours a day, how many men must be employed to make an embankment 300 yards long, 30 feet wide, and 4 feet high, in 8 days working 8 hours a days?

2. What would £650 amount to in 3 years at 4 per cent. per annum compound interest?

3. Find the square root of 88,755,241.

4. Four feet being the area of a map which is laid down on the scale of an inch to a mile, required the number of acres represented.

Answers.—*A.* (1) £127 16s. (2) £$19\frac{5}{8}$. (3) The man £6 15s., woman £3 7s. 6d., child £1 2s. 6d. (4) 120 quarters.

B. (1) 300 men. (2) £731 3s. 2·784d. (3) 9,421. (4) 368,640 acres.

Composition.—Write about *Bread*, under the heads (*a*) the Farmer, (*b*) the Miller, (*c*) the Baker.

STANDARDS VI.—VII.

Grammar.—Parse the words in italics:—
'Ah! *little think* they *as* they dance *along, how* many feel this moment, death, and all the sad *variety* of pain! How many sink in the devouring flood, or more *devouring* flame.'

Analyse.—'The lord might not kill or maim his villein, but he might beat him with impunity.'

Oral questions: How many kinds of sentences are there? What is a subordinate sentence? How can you tell an adjective sentence? What is a complex sentence? What is an adjunct? What are adjuncts employed to denote? Give suitable adverbial clauses to each of the following principal clauses:—The boy can learn. You must not talk. We stood by. Send me a book.

Practical Perspective for Pupil Teachers.

BY

E. G. BAKER, B.SC., B.A.,

Vice-Principal of the Training College, Carmarthen.

II.

PERSPECTIVE DRAWING.

PERSPECTIVE Drawing literally means 'Drawing by looking through,' and a very common experiment will explain, or at least illustrate, the nature of this kind of drawing.

Take a piece of tissue, or any other thin paper through which objects may be seen, and fasten it against a window pane. Then take a pencil, and, *with the eye kept in a fixed position*, trace on the

paper the outline of some object outside. This sketch will be a Perspective Drawing of the object, and it is manifest that it is a drawing of the object *as it appears*. Hence will be seen the necessity for keeping the eye fixed in one position until the drawing is complete, for every change of position alters the appearance somewhat. The necessity of keeping the eye fixed may be shown by moving it, when any line drawn will be seen not to cover the line it represents, and hence neighbouring lines drawn with the eye in the new position do not fall into proper relative positions with respect to the first line. Ablett's drawing frame is very useful at this stage.

Now it is the object of the study of Perspective to enable us, first of all by the aid of drawing instruments and afterwards without them, to make drawings of objects as they appear to us when looked at from any position, without actually placing the paper on which the object is to be drawn erect in front of the object, as in the above experiment. The architect does this from given measurements (by scale), and without actually seeing the object, nay, often before the object is in existence, as in the case of a house which is to be built from plans. The artist draws from observation and without actual measurement, securing only accurate proportion. Each imagines the transparent paper placed upright in front of him, and between his eye and the object; and his actual drawing is a reproduction on a larger or smaller scale of what would be found on the vertical sheet of paper if a drawing were obtained by actual tracing as described above.

The whole theory of Perspective Drawing depends upon the physical fact that *rays of light travel in straight lines*. Of this truth we may find many illustrations. Take for example the path of a sunbeam shining into a room, the path being marked out by the particles of dust floating in the air.

Now every object, as ordinarily observed, is seen by means of *rays of light which travel from every point of it in straight lines to the eye.*

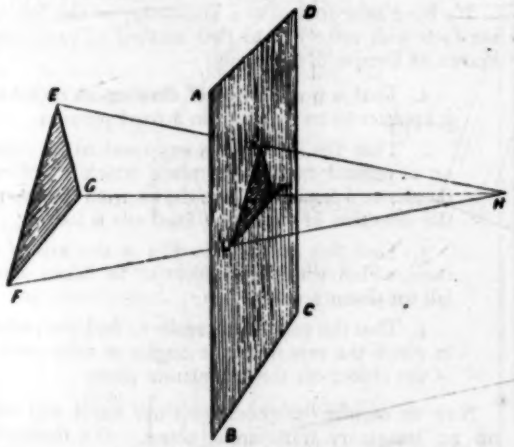


Fig. 12.

Thus if we suppose H in Fig. 12 to be a man's eye looking at the triangle EFG, rays of light proceed from every point of it to his eye. The lines EH, &c., show the paths of the rays which enter the eye from the three angles of the triangle. If now we suppose a vertical transparent plane ABCD, between his eye and the triangle, these three particular rays cut the plane in three points, one for each. If K, L and M denote these points, and we suppose the man to be provided with a pencil with which to trace the Perspective drawing of the triangle EFG, the drawing will be the triangle KLM. Now the same result would have been obtained if the pencil had been used first of all simply to mark the points K, L and M, and these had afterwards been joined by straight lines. It will be found that the making of Perspective Drawings is really what has just been described. The paper on which the drawing is made is supposed to be the transparent plane (A B C D in fig. 12); then the points are found (by methods soon to be explained) in which the rays from the corners or other points of the object drawn cut the plane, and, finally, these points are joined by lines.

It will have been recognised that a Perspective Drawing is the result of conical projection of an object, the eye being the vertex or pole of projection, and the sheet of paper, on which the drawing is made, the plane of projection.

From fig. 12 it is easily seen that the size of the drawing on the plane, for any position of the eye, is increased by moving the plane nearer the object, and *vice versa*. In all the problems that follow, this distance of the plane from the object will be given by stating how far from the plane the point of the object which is nearest to it is situated. This distance (which is of course measured perpendicularly) is called the *distance of the nearest point in the picture*. By *in the picture* then, is meant, *behind the plane of projection*.

We have seen that the size of our picture of an object, for a given position of the eye, depends on the position of the plane of projection. Now we have as yet said nothing about the distance of the eye from the object which is to be drawn. This distance is determined by the fact that the eye for one position cannot receive distinct impressions of objects which lie beyond a certain limit to the right or left, upwards or downwards. Teachers are aware from experience that to command a class which has a wide front they must stand farther back than is necessary if the class has a narrow front.

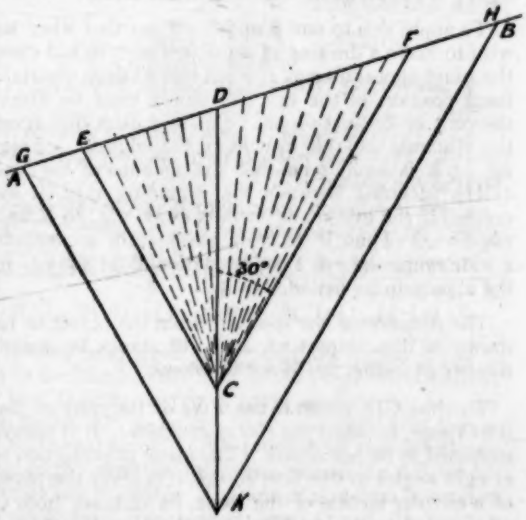


Fig. 13.

Let AB (fig. 13) be a straight line, and C the position of the eye of an observer, the eye being supposed to remain fixed and looking in the direction CD. Now rays of light enter the eye from every point of the line; suppose the dotted lines to represent the rays. Draw CE and CF so that the angles DCE and DCF are each 30°. It is found that the rays which lie outside the angle ECF do not cause distinct impressions on the eye, *i.e.*, the line ceases to be distinctly seen outside the points E and F. This fact may easily be demonstrated by experiment. Now this applies to lines drawn in any direction, *i.e.*, no ray of light from a point to the eye gives a distinct impression, if the ray makes an angle greater than 30° with the line CD, which shows the direction in which the eye is looking. If all possible rays which make angles of 30° with CD, be drawn, they will lie on the surface of a cone (fig. 14).

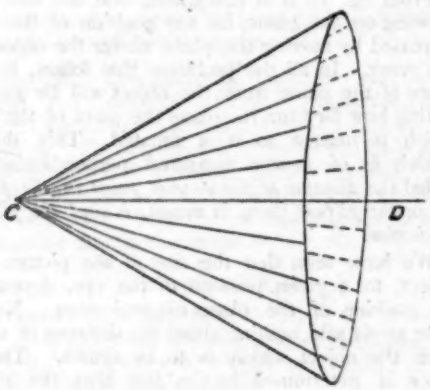


Fig. 14.

The angle ECF (fig. 14), which is an angle of 60°, is called the *visual angle*, and the cone shown in fig. 14 is known as the *cone of distinct vision*.

To apply this to our purpose, we say that when we wish to make a drawing of an object such as will show the exact appearance of it when viewed from a certain fixed position of the eye, the object must lie within the cone of distinct vision. But how does this affect the distance of the eye from the object? From fig. 13 it is easily seen that the amount of the line (GH), included between the bounding rays, is increased if the eye move further away, *e.g.*, to K and *vice versa*. Thus, if we wish our picture to include a wide range the eye must be stationed far away from the objects to be included in it.

The distance of the spectator from the object to be drawn is thus important, and will always be stated, directly or indirectly, in our problems.

The line CD, which is the *axis* of the cone of distinct vision, is called the *line of direction*. It is always supposed to be horizontal. The plane of projection is at right angles to this line, so that it is really the plane of a circular section of the cone, its distance from C (the eye) determining the size of the picture.

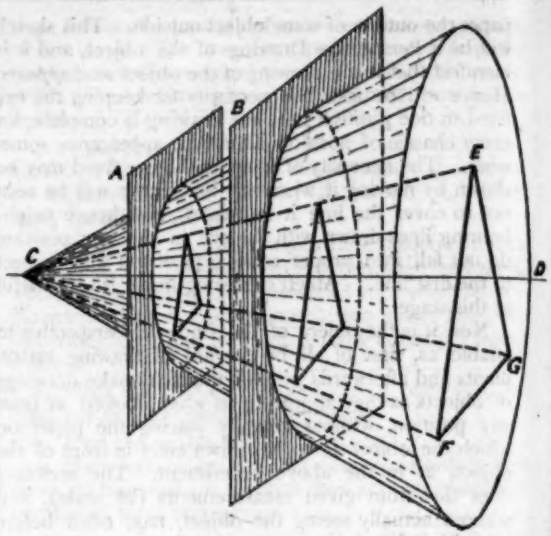


Fig. 15.

The accompanying figure (fig. 15) will illustrate all that has just been stated. The eye of the spectator at C looks horizontally in the direction CD. The line CD is the *line of direction*. The cone of distinct vision is shown, and falling within it a triangle EFG.

Two transparent planes are shown, A and B, which are perpendicular to CD, the line of direction. The rays from E, F, and G to the eye at C, are drawn with dotted lines, and the points where they cut the planes of projection are joined so as to give a picture of the object on each plane. It can be seen from the figure that the size of the picture is greater on the plane further from the eye.

In what follows, the cone of distinct vision will be omitted, it being always understood that the object to be drawn is so placed as to fall within it.

We have now arrived at a knowledge of the following facts with reference to that method of projection known as Perspective Drawing:—

1. That it is a method of drawing an object as it appears to an eye kept in a fixed position

2. That the drawing is supposed to be made on a vertical transparent plane which is perpendicular to a horizontal line drawn from the eye in the direction in which the fixed eye is looking.

3. That this *line of direction* is the axis of a cone, within which the object to be drawn must fall for distinct vision.

4. That the problem is really to find the points in which the rays from the angles or other points of the object cut the transparent plane.

Now we require the drawing on our paper and not on an imaginary transparent plane. We therefore suppose our paper to take the place of this plane, and we require to find points on the paper which when joined give the drawing required. We are now entering upon the practical part of the subject, and a careful study of fig. 16 will disclose to us the first of two important rules which enable us to obtain the points mentioned above.

For the present we shall deal only with horizontal lines, and show how to obtain perspective drawings of them.

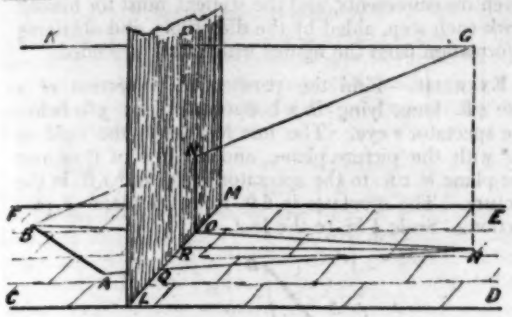


Fig. 16.

Let AB be a horizontal line in the horizontal plane CDEF, G the position of the observer's eye, GK the line of direction perpendicular to the vertical plane P on which the picture of AB is to be drawn, hence called the *picture plane*. Also let GH show the height of the eye above the horizontal plane which contains the line AB. The picture plane intersects this horizontal plane in a line LM, called the *picture line*.

The horizontal plane may be represented by the floor, a line being drawn on it. The picture plane may be represented by a vertical sheet of glass.

Such a piece of apparatus as Ablett's glass frame for illustrating Perspective is very useful.

N.B.—If AB were on the ground, CDEF would be called the *ground plane* and LM the *ground line*. In that case H would be the position of the spectator's foot, and is called the *station point*.

Now BG is the ray by which the end B of the line is seen. Join BH. Then BGH is a vertical plane, and it intersects the vertical picture plane in a vertical line. This line is evidently ON, and N is the position for the point B on the picture plane Similarly the position of A can be found by joining AG and AH and drawing a perpendicular where AH cuts LM.

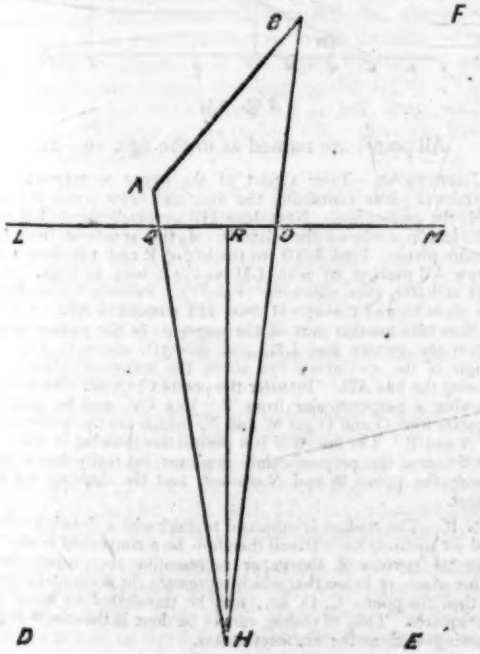


Fig. 17.

In practice these perpendiculars are found by methods shown in the following figures. In fig. 17 is shown the horizontal plane of fig. 16. The line LM (picture line), as in fig. 16, is the intersection of the picture plane with it. The point H, which is perpendicularly below the spectator's eye, is placed at the right distance HR, *i.e.*, the distance of the picture plane from the spectator, from the line LM, and the object, the line AB, is placed in the right position. By joining AH and BH we get the points O and Q of fig. 16.

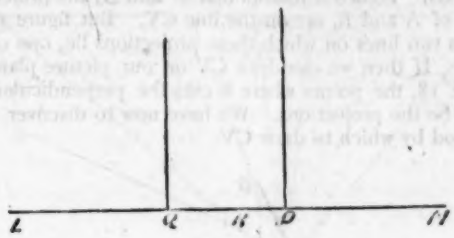


Fig. 18.

Now we take another part of our paper, fig. 18, to represent the picture plane, and draw on it the line LM, marking a point R to denote the same point in figs. 16 and 17.

Then from fig. 17 measure the distances RO and RQ, and transfer them to the picture line in fig. 18.

Drawing perpendiculars on our picture plane from O and Q, we know that A and B, when shown in their proper perspective positions, will be somewhere on these perpendiculars, A on the perpendicular from Q, and B on that from O. We have now to find a method of fixing these positions on the perpendiculars. But before proceeding the student should make himself master of the relations between figs. 16, 17 and 18, and especially of the connection between 17 and 18, as these two latter constructions, supplemented by one other, give the whole of the method employed for obtaining Perspective Drawings in the remainder of these articles.

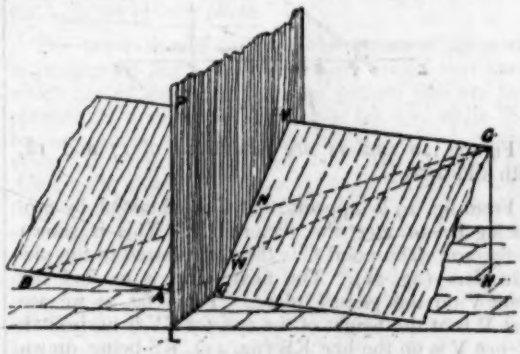


Fig. 19.

Having recognised clearly that the points A and B are to be found somewhere on the perpendiculars from O and Q in fig. 18, next study carefully fig. 19. In this figure, AB, as before, shows the horizontal line in its horizontal plane, G the position of the spectator's eye, H the point on the plane containing AB, which is vertically below G. The line of direction is omitted for clearness. The picture line LC and the picture

plane P are shown. The line AB is shown produced, and cutting the picture line in C. Draw through G a line parallel to AB. This line will be horizontal. Let it meet the picture plane in V. Now since GV and AB are parallel lines, they are in the same plane. This oblique plane is shown, and it intersects the picture plane in a line CV, and CV is in each plane. The lines BG and AG, as before, are the rays from A and B to the eye, and they are in the oblique plane, for B and G are in that plane, and also A and G. Therefore the lines CV and BG intersect, as also CV and AG. Hence it follows that W and N, the projections of A and B, are on the line CV. But figure 18 shows two lines on which these projections lie, one on each. If then we can draw CV on our picture plane in fig. 18, the points where it cuts the perpendiculars must be the projections. We have now to discover a method by which to draw CV.

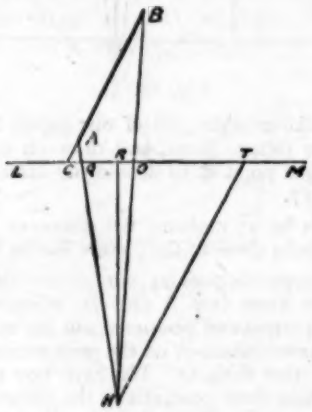


Fig. 20.

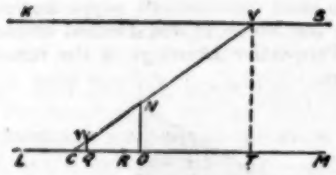


Fig. 21.

Figures 20 and 21 are repetitions of 17 and 18, with additions.

From fig. 19 it appears that C is obtained by producing BA to meet the picture line. This is shown in fig. 20. The point C is then transferred to the picture plane (fig. 21). The next thing is to find the point V on the picture plane. From fig. 19 we see that V is at the height of the eye, for GV is horizontal. Hence V is on the line KS (fig. 21), KS being drawn parallel to LM at the distance GH (fig. 19) from it. In fig. 20 draw through H the line HT parallel to AB. The point T is perpendicularly below V. Therefore transfer T to the picture plane (fig. 21), and draw TV perpendicular to LM to meet KS. The point V is then found. Join CV, and where it meets the perpendiculars from O and Q, are the points W and N. The line WN is the perspective projection of AB.

No measurements were given in the above as the object desired was simply to teach principles. We will now work an exercise similar to the above from given measurements, and the student must for himself work each step, aided by the directions, and obtaining information from the figures which have preceded.

EXERCISE.—Find the perspective projection of a line 4 ft. long, lying in a horizontal plane 3 ft. below the spectator's eye. The line recedes to the right at 50° with the picture plane, and the end of it nearest the plane is 1 ft. to the spectator's left, and 1 ft. in the picture. The spectator is 6 ft. from the plane of projection. Scale ½ in. to the foot.

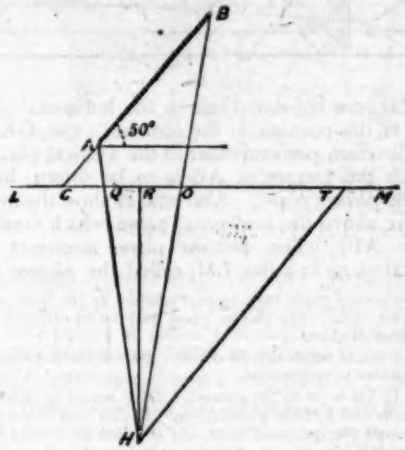


Fig. 22.

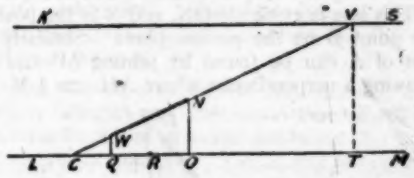


Fig. 23.

All points are named as in the figs. 16—21.

DIRECTIONS.—Take a part of the paper to represent the horizontal plane containing the line, and draw across it a line LM, the picture line. Next draw HR perpendicular to LM and 6 ft. long; it shows the distance of the spectator from the picture plane. Find A 1 ft. to the left of R and 1 ft. from LM. Draw AB making 50° with LM and 4 ft. long by scale. Join AH and BH, thus obtaining O and Q. Produce BA to obtain the point C, and through H draw HT parallel to AB.

Now take another part of the paper to be the picture plane. Draw the picture line LM, and KS 3 ft. above it, *i.e.*, the height of the spectator's eye above the horizontal plane containing the line AB. Transfer the points C, Q, &c. Find V by drawing a perpendicular from T. Join CV, and by perpendiculars from Q and O get W and N, which are the projections of A and B. The line WN is a perspective drawing of AB.

Of course the perpendiculars need not be really drawn, but merely the points W and N marked, and the drawing will be neater.

N.B.—The student is supposed to work with a drawing-board and set squares, &c. It will therefore be a convenient course to take the portion of the paper representing the picture plane either above or below that which represents the horizontal plane, as then the points C, Q, &c., may be transferred by means of the squares. This, of course, cannot be done in the case of large drawings such as the architect makes.

PROBLEMS.

Scale ½ in. to the foot.

1. Draw the perspective projection of a line in a horizontal plane 4 ft. below the spectator's eye. The line is 4 ft. long and recedes to the left at 60° with the picture plane. The nearer end of the line is 2 ft. to the right and 1 ft. in the picture. The spectator is 8 ft. from the picture plane.

2. Make a perspective representation for an eye 10 ft. from the picture plane and 3 ft. above the horizontal plane containing the line, of a horizontal line 5 ft. long, one end of which touches the picture plane at a point 2 ft. to the left of the spectator. The line recedes from the picture plane at 45° towards the right. (N.B.—The points A and C coincide.)

3. Place in perspective a line lying on the ground and receding to the left at 50° with the picture plane. The line is 4 ft. long and its nearer end is 2 ft. to the right and 2 ft. in the picture. The spectator is 9 ft. from the picture plane and 5 ft. high. (N.B.—The ground is the horizontal plane containing the line, and the *picture line* is what was defined above as the *ground line*. The height of the spectator is the height of his eye above the horizontal plane containing the line.)

4. Draw the perspective projection of two lines AB, AC, in a horizontal plane for an eye 6 ft. above their plane and 8 ft. from the picture plane. The angle A is in front of the spectator and 1 ft. in the picture, and AB recedes to the right at 60° with the picture plane. The angle BAC is 50°. The lines are equal and 3 ft. long. (N.B.—The point A is on HR produced. Since BAC is 50° and AB recedes at 60°, therefore AC recedes at 70° to the left. First obtain the projection of AB as usual, and all that will then be required will be V for AC and the perpendicular on which C lies.)

5. Place in perspective two lines AB, AC, the point A being 1 ft. to the left and 2 ft. in the picture. The lines lie on the ground and AB makes an angle of 45° with the picture plane, receding to the right. The angle BAC is 90° and the line AB is 3 ft. long, while AC is 4 ft. Height of spectator, 5 ft.; distance from picture plane, 10 ft.

6. Make a perspective representation of two lines AB, AC, which lie in a horizontal plane 2 ft. below the eye of the spectator. The angle A touches the picture plane in front of the spectator, and is 60°, while AB recedes to the right at 50° with the picture plane. The lines are 4 ft. long, and the spectator is 6 ft. distant from the picture plane. (N.B.—AC recedes to the left at 70°. If BC were joined ABC would be an equilateral triangle.)

7. Place in perspective an equilateral triangle in a horizontal plane 5 ft. below the spectator's eye. The sides of the triangle are 4 ft. long, and one side recedes to the right at 70° with the picture plane. The nearest angle is 2 ft. to the right and 1 ft. in the picture, and the spectator is 9 ft. distant from the picture plane.

8. Draw the perspective projection of two horizontal lines meeting at right angles; one 3 ft. long and the other 4 ft. long. The right angle from which they diverge is 1 ft. to the left and 2 ft. in the picture, and the shorter line recedes to the right at 50°. They lie in a plane 3 ft. above the spectator's eye, and the distance of the spectator from the picture plane is 6 ft.

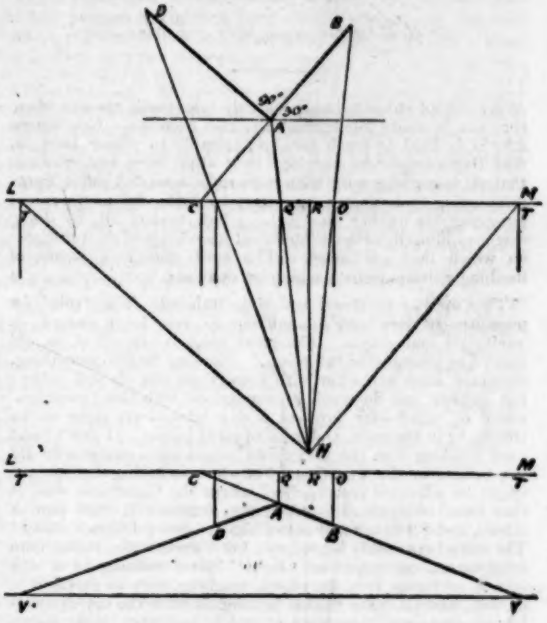


Fig. 24.

DIRECTIONS.—Draw the picture line, &c., as before in the plane of the lines. This line is above the level of the eye, so that KS, the line on which V, V are to be found on the picture plane, is below LM. A little thought will make the method clear, as the principles are the same as before.

9. Make a perspective drawing of an equilateral triangle in a horizontal plane, with sides 4 ft. long, as seen by an eye 3 ft. below its plane, and 9 ft. from the picture plane. The nearest angle of the triangle is 2 ft. to the right and 1 ft. in the picture, and one side recedes to the right from this point at an angle of 70° with the picture plane.

The pupil should compare the results of his work in problems 7 and 9. He will then notice that lines which run *up* the paper from the picture line are the perspective drawings of lines *below* the eye, while the representations of similar lines *above* the level of the eye run *down* from the picture line. He will have no difficulty in seeing that lines which are on a level with the eye neither run *up* nor *down* when drawn in perspective, but are horizontal In fact in this case LM (picture line) and KS coincide. It will also appear that the amount of *slope* of such lines when drawn in perspective depends upon the distance above or below the eye, the greater the distance the greater the slope, and *vice versâ*. Note that the above refers only to the perspective drawing of horizontal lines. It will be of advantage if the pupil make sketches from objects so placed as to illustrate these principles, or if the glass frame referred to above be used to demonstrate them.

(To be continued.)

plane P are shown. The line AB is shown produced, and cutting the picture line in C. Draw through G a line parallel to AB. This line will be horizontal. Let it meet the picture plane in V. Now since GV and AB are parallel lines, they are in the same plane. This oblique plane is shown, and it intersects the picture plane in a line CV, and CV is in each plane. The lines BG and AG, as before, are the rays from A and B to the eye, and they are in the oblique plane, for B and G are in that plane, and also A and G. Therefore the lines CV and BG intersect, as also CV and AG. Hence it follows that W and N, the projections of A and B, are on the line CV. But figure 18 shows two lines on which these projections lie, one on each. If then we can draw CV on our picture plane in fig. 18, the points where it cuts the perpendiculars must be the projections. We have now to discover a method by which to draw CV.

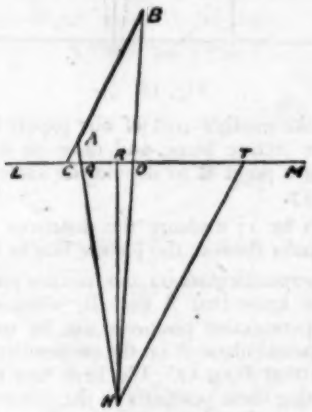


Fig. 20.

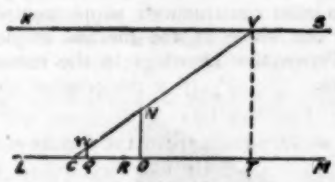


Fig. 21.

Figures 20 and 21 are repetitions of 17 and 18, with additions.

From fig. 19 it appears that C is obtained by producing BA to meet the picture line. This is shown in fig. 20. The point C is then transferred to the picture plane (fig. 21). The next thing is to find the point V on the picture plane. From fig. 19 we see that V is at the height of the eye, for GV is horizontal. Hence V is on the line KS (fig. 21), KS being drawn parallel to LM at the distance GH (fig. 19) from it. In fig. 20 draw through H the line HT parallel to AB. The point T is perpendicularly below V. Therefore transfer T to the picture plane (fig. 21), and draw TV perpendicular to LM to meet KS. The point V is then found. Join CV, and where it meets the perpendiculars from O and Q, are the points W and N. The line WN is the perspective projection of AB.

No measurements were given in the above as the object desired was simply to teach principles. We will now work an exercise similar to the above from given measurements, and the student must for himself work each step, aided by the directions, and obtaining information from the figures which have preceded.

EXERCISE.—Find the perspective projection of a line 4 ft. long, lying in a horizontal plane 3 ft. below the spectator's eye. The line recedes to the right at 50° with the picture plane, and the end of it nearest the plane is 1 ft. to the spectator's left, and 1 ft. in the picture. The spectator is 6 ft. from the plane of projection. Scale ½ in. to the foot.

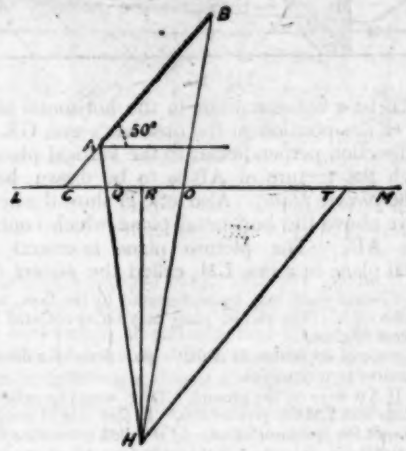


Fig. 22.

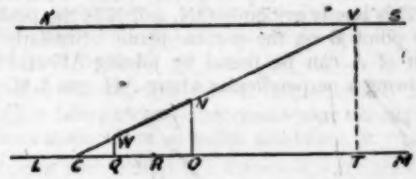


Fig. 23.

All points are named as in the figs. 16—21.

DIRECTIONS.—Take a part of the paper to represent the horizontal plane containing the line, and draw across it a line LM, the picture line. Next draw HR perpendicular to LM and 6 ft. long; it shows the distance of the spectator from the picture plane. Find A 1 ft. to the left of R and 1 ft. from LM. Draw AB making 50° with LM and 4 ft. long by scale. Join AH and BH, thus obtaining O and Q. Produce BA to obtain the point C, and through H draw HT parallel to AB.

Now take another part of the paper to be the picture plane. Draw the picture line LM, and KS 3 ft. above it, *i.e.*, the height of the spectator's eye above the horizontal plane containing the line AB. Transfer the points C, Q, &c. Find V by drawing a perpendicular from T. Join CV, and by perpendiculars from Q and O get W and N, which are the projections of A and B. The line WN is a perspective drawing of AB.

Of course the perpendiculars need not be really drawn, but merely the points W and N marked, and the drawing will be neater.

N.B.—The student is supposed to work with a drawing-board and set squares, &c. It will therefore be a convenient course to take the portion of the paper representing the picture plane either above or below that which represents the horizontal plane, as then the points C, Q, &c., may be transferred by means of the squares. This, of course, cannot be done in the case of large drawings such as the architect makes.

PROBLEMS.

Scale ½ in. to the foot.

1. Draw the perspective projection of a line in a horizontal plane 4 ft. below the spectator's eye. The line is 4 ft. long and recedes to the left at 60° with the picture plane. The nearer end of the line is 2 ft. to the right and 1 ft. in the picture. The spectator is 8 ft. from the picture plane.

2. Make a perspective representation for an eye 10 ft. from the picture plane and 3 ft. above the horizontal plane containing the line, of a horizontal line 5 ft. long, one end of which touches the picture plane at a point 2 ft. to the left of the spectator. The line recedes from the picture plane at 45° towards the right. (N.B.—The points A and C coincide.)

3. Place in perspective a line lying on the ground and receding to the left at 50° with the picture plane. The line is 4 ft. long and its nearer end is 2 ft. to the right and 2 ft. in the picture. The spectator is 9 ft. from the picture plane and 5 ft. high. (N.B.—The ground is the horizontal plane containing the line, and the *picture line* is what was defined above as the *ground line*. The height of the spectator is the height of his eye above the horizontal plane containing the line.)

4. Draw the perspective projection of two lines AB, AC, in a horizontal plane for an eye 6 ft. above their plane and 8 ft. from the picture plane. The angle A is in front of the spectator and 1 ft. in the picture, and AB recedes to the right at 60° with the picture plane. The angle BAC is 50°. The lines are equal and 3 ft. long. (N.B.—The point A is on HR produced. Since BAC is 50° and AB recedes at 60°, therefore AC recedes at 70° to the left. First obtain the projection of AB as usual, and all that will then be required will be V for AC and the perpendicular on which C lies.)

5. Place in perspective two lines AB, AC, the point A being 1 ft. to the left and 2 ft. in the picture. The lines lie on the ground and AB makes an angle of 45° with the picture plane, receding to the right. The angle BAC is 90° and the line AB is 3 ft. long, while AC is 4 ft. Height of spectator, 5 ft.; distance from picture plane, 10 ft.

6. Make a perspective representation of two lines AB, AC, which lie in a horizontal plane 2 ft. below the eye of the spectator. The angle A touches the picture plane in front of the spectator, and is 60°, while AB recedes to the right at 50° with the picture plane. The lines are 4 ft. long, and the spectator is 6 ft. distant from the picture plane. (N.B.—AC recedes to the left at 70°. If BC were joined ABC would be an equilateral triangle.)

7. Place in perspective an equilateral triangle in a horizontal plane 5 ft. below the spectator's eye. The sides of the triangle are 4 ft. long, and one side recedes to the right at 70° with the picture plane. The nearest angle is 2 ft. to the right and 1 ft. in the picture, and the spectator is 9 ft. distant from the picture plane.

8. Draw the perspective projection of two horizontal lines meeting at right angles; one 3 ft. long and the other 4 ft. long. The right angle from which they diverge is 1 ft. to the left and 2 ft. in the picture, and the shorter line recedes to the right at 50°. They lie in a plane 3 ft. above the spectator's eye, and the distance of the spectator from the picture plane is 6 ft.

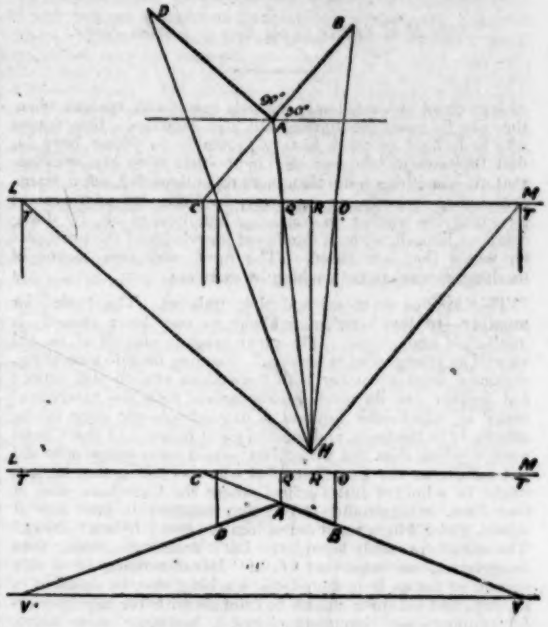


Fig. 24.

DIRECTIONS.—Draw the picture line, &c., as before in the plane of the lines. This line is above the level of the eye, so that KS, the line on which V, V are to be found on the picture plane, is below LM. A little thought will make the method clear, as the principles are the same as before.

9. Make a perspective drawing of an equilateral triangle in a horizontal plane, with sides 4 ft. long, as seen by an eye 3 ft. below its plane, and 9 ft. from the picture plane. The nearest angle of the triangle is 2 ft. to the right and 1 ft. in the picture, and one side recedes to the right from this point at an angle of 70° with the picture plane.

The pupil should compare the results of his work in problems 7 and 9. He will then notice that lines which run *up* the paper from the picture line are the perspective drawings of lines *below* the eye, while the representations of similar lines *above* the level of the eye run *down* from the picture line. He will have no difficulty in seeing that lines which are on a level with the eye neither run *up* nor *down* when drawn in perspective, but are horizontal In fact in this case LM (picture line) and KS coincide. It will also appear that the amount of *slope* of such lines when drawn in perspective depends upon the distance above or below the eye, the greater the distance the greater the slope, and *vice versâ*. Note that the above refers only to the perspective drawing of horizontal lines. It will be of advantage if the pupil make sketches from objects so placed as to illustrate these principles, or if the glass frame referred to above be used to demonstrate them.

(To be continued.)

Civic and Moral Training in Schools.*

BY THE REV. DR. ABBOTT,

Late Head Master of the City of London School.

MOST school subjects imply not only rules (with reasons where they can be made intelligible) but also exercises. One reason why it is hard to teach history profitably to young boys is, that they cannot 'do exercises' in it—that is to say, exercises that are something more than mere repetitions. A pupil learns arithmetic, or Latin, or geometry, by being led up to rules; by seeing his teacher do exercises; but, best of all, by doing exercises himself, with an intelligent knowledge of the principles on which they are based. The most efficacious means of teaching appears to be teaching by exercises.

This applies to moral and civic training. The 'rule' for morality—to love one's neighbour as one loves oneself—is intelligible and simple. The great point is—for all of us, old as well as young—the 'exercises.' Reading may do something, discourse from a teacher with convictions can do still more; but neither can do much in comparison with the 'exercises,' many of which—for boys at a day school—are done in the streets, or in the train, and most of all at home. 'I don't mind your teaching him the Catechism'—said some parent who did not believe in the Catechism, but who was asking that his son might be admitted into a school where the Catechism was, at that time, indispensable—'You may hammer it into him at school, and I'll hammer it out of him at home; I shan't object.' The story is probably legendary; but it understates, rather than exaggerates, an important truth. Moral training in a day school, so far as it is mere book teaching, may be excellent in its way, and yet quite unable to compete with the more powerful training—not 'hammering' at all, but much more silent, persistent, and efficacious—of the out-of-school world.

I make no apology, then, for speaking first of 'exercises' in morality, although there is nothing novel in this part of the subject. If teachers were waiting to give moral and civic training until the publication of some authoritative text-books on it, I am convinced that it would never be given. The text-book might be published, but it would be sure to disappoint expectations. If we cannot make a considerable use of the instruments at our command, no new instrument is likely to help us much. My impression is that our present means may be better used than they have been; and, therefore, though I shall touch on the introduction of new means, I shall lay most stress upon the improved use of the old. But bearing in mind that many of my suggestions may have been anticipated by others who have long acted on them, I will ask you to excuse me if I state points briefly, rather as subjects for discussion than as defined conclusions.

First, then, what means are there of securing the co-operation of parents, and can they be improved? Are there monthly or other reports sent home to them? If there are not, and if there is a general feeling that this would be useful in itself, but more than counterbalanced by the increased burden of secretarial work, already perhaps too heavy, could not the secretarial assistance be increased? I have heard that the principals of some schools encourage meetings of parents now and then at the school, in pre-arranged groups, to talk over school matters with the teachers: is this practicable? A society has lately been established called the 'Parents' National Educational Union,' one object of which is 'to secure greater unity and continuity of education by harmonising home and school training.' How far can such a society be useful? And, if it can be of use, can we co-operate with it?

Next, as to training in the school itself. We all know that if the tone of a school is to be good, the teacher must be in touch with his pupils, realising their individual difficulties and temptations, appreciating their efforts, and understanding and making allowance for—even while firmly punishing—their faults. But this cannot be done if the teacher's time is wholly taken up with preparing pupils for examinations, or if he is distracted between many classes. Lecturers do good work, but lecturers cannot give training in morality; and a teacher of many classes tends to become a lecturer. Where a teacher's attention is thus distracted (and there are many intellectual advantages to be pleaded for the system which thus utilises specialists as teachers), it becomes desirable that a group of boys should be attached during the term to some one master whom they may consult as their friend in troubles and difficulties, and to whom they must present regular reports of their work and conduct. If a teacher has not time or opportunity for acquiring more than a mere intellectual knowledge of the pupils under his care, the moral loss to them is very great. An over-worked teacher tends to become a machine, and a teaching machine produces in its pupils machine-like learning, and machine-like morals.

Not, indeed, that I underrate the minor and mechanical habits of punctuality, neatness, orderliness, and general attention to things seemly. Drill, in itself, exercises a good influence, though much depends upon the spirit of the drill and character of the instructor; but these small habits also constitute a kind of drill, which strengthens the mind, increases energy, self-respect, and self-control, and forms a kind of bulwark or outer circle to resist attacks against morality. And how often it happens that the mere mechanical arrangements of a school, or parts of a school, fight, so to speak, against these minor moralities! Ill-constructed passages, or staircases, or lavatories, or cloak-rooms, or ill devised arrangements in connection with them—how often do they encourage disorder, bullying, dishonesty, suspicion of dishonesty, and a generally bad tone! I have often seen, and still sometimes see, young boys emerging from schools into the street, who regularly act as though there were no accommodation for decency in the school, and whose conduct toward one another would certainly not suggest that in that very afternoon they had been receiving a lesson on the Sermon on the Mount. Certainly, therefore, so far from underrating the machine-like routine of ordinary school discipline, I am of one mind with the head master of the most successful day school in London—or, I may say, in England—who told me that, in a former school of his, the chairman of his council, after visiting the class-rooms, was in the habit of saying, 'I don't believe much good is being done in Mr. So-and-so's room; there's too much paper on the floor'; 'and,' continued the head master, 'the chairman was right'; and I say now, too, as I said then, 'the chairman was right.' And I wish I could induce all the members of my profession, especially the untrained members, to believe in that chairman.

But, still, while enforcing exact obedience to school rules, you must not—under penalty of becoming a martinet yourself, and inflicting great injury on your pupils—neglect to remind yourself constantly that these small school rules are but means to a great end. You may inculcate discipline and order as means for getting on in life (and I am by no means disposed to deny that for boys of a certain kind and at a certain stage that argument may sometimes be rightly used), but, as a basis for morality, they must be enforced on the ground of the good of the school—the common good. If the young can be made to recognise that the school rules are for the school's interest, then, and not till then, in the simplest actions of school routine, by giving a willing and intelligent obedience, they are being imperceptibly imbued with that habit of subordinating private inclinations to public benefit, which is one of the best means of preparing a boy in a school to become a citizen in a state.

But, now, to pass from the 'exercises' of the pupils to those of the master. They are, of course, not direct or deliberate, nor even conscious for the most part; but, for this very reason they are often most effective, when they naturally and spontaneously spring out of his management and control of the class. I sometimes think a teacher might do more for the morality of his pupils than he is aware by paying an absolute and almost punctilious respect to their rights, and by consulting the wishes of the majority on small occasions where no harm can be done. To keep pupils over time, because you are greatly interested in a lesson, is a mark of zeal; to do it because you came into the class-room after your time is a mark of penitence; but in neither case is it quite fair. Again, if boys are fined for dropping paper or leaving books about, is it altogether quixotic that a master should himself contribute to the fine fund for similar offences? Then, as regards the administration of justice and punishment of faults, although the pressure of work in a great school prevents nice discriminations and lengthy inquiries, still, the habit of always allowing an appeal (after lesson), even to the perpetrator of seventy-times-seven offences, is so valuable to our pupils as to be worth some expense of a master's time and energy. Some masters think it right to punish a whole class for the fault of one or two undetected pupils in it. I would not go so far as to say that it is not right; but I am pretty sure that it is not wise. For the same result can be obtained by

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holding an investigation after school hours, at which, of course, you require the attendance of the whole class for the purpose of giving evidence. Thus you inconvenience the whole class, as also you inconvenience yourself; but you do not treat the whole class as guilty any more than you treat yourself as guilty. The lesson to be deduced from these natural inconveniences is that if one member of a body goes wrong, the whole of the body is liable to suffer; and this is a profound moral and civic truth well worth inculcating in practice. But it is all lost if you arbitrarily say, 'since I cannot detect the one offender in a class of forty, I will punish thirty-nine innocent boys simply that I may punish one guilty one?' I lay the more stress upon justice because it is the one virtue that is open to all teachers to practise, and easy for all pupils to understand and respect.

Many teachers are so shy and reserved, or so afraid of being partial or indulgent, that they cannot make themselves liked; but they can all make themselves respected if they are just. No lessons on morals are of much use from a master who is not respected by his pupils; but a perfectly just teacher, even though he may give no moral lessons, is a great indirect teacher of morality.

Discrimination between offences, and adaptation of punishments to faults, are excellent 'moral exercises,' and it is needless to dwell on the mischief that would arise if no more severe punishment could be inflicted on dishonesty and indecency than on inattention, carelessness, or unpunctuality. For this reason, f for no other, I am disposed to think that corporal punishment should be regularly used, to draw a line, intelligible to the whole school, between the graver and the lighter faults. I have grown to dislike inflicting corporal punishment more and more; yet, if I were to begin a schoolmaster's life over again, I would do one of two things, I would either cane more often than I did, or else I would introduce a substitute of the following kind: I would try the experiment of a *concordat*, a compact with my pupils after this fashion: 'So-and-so has lowered the character of the school by committing such-and-such an offence, and deserves to be caned; but I should much prefer not to cane him if the boys will punish him themselves by not speaking to him for a week. If the boys do this, I shall not punish him myself in any way. So many as promise this, hold up their hands.' Great care would be needed at first to ensure that the boys kept their promise, but if they did, and if it became a school tradition, I think it would be an excellent tradition. The experiment has perhaps been tried by many here present; if not, it seems worth trying.

Meantime, greatly though we may dislike inflicting corporal punishment, it is our duty to inflict it, if it is for the good of the school as a whole. From an interesting Report of Mr. Fitch on American Schools, published last year, I learn that 'in most of the state and city regulations teachers are absolutely forbidden to inflict it'; and that is a point well worth considering. One would like to know what punishments are reserved for graver offences; whether the teachers themselves acquiesce in this restriction; whether they are satisfied with the tone and morality of their pupils as well as with the outward order and discipline which favourably impressed Mr. Fitch; and whether there is, owing to national character and circumstances, an earlier seriousness and sense of responsibility among boys at school and young men at the universities in the United States. It may be we can learn something from a fuller knowledge of what is done elsewhere. But meantime, I hope none of my fellow-teachers will be deterred from their duty by mere abstract arguments apart from facts. 'Caning brutalises a boy,' people say. I do not believe it does, unless a brute holds the cane. But, if it did, bullying, falsehood, dishonesty, and indecency, do worse than brutalise him; and not only him, but also the innocent companions among whom he is spreading the infection of his evil habits. Under proper regulations, and in the hands of experienced and responsible teachers, the cane seems to me an instrument for good in English schools as at present constituted; and if, as I believe, this is the general opinion not only of school teachers but also of school managers, it seems time that some pressure should be brought to bear upon those magistrates who set their faces against caning under any circumstances. The magistrate's son, if he went to a public school, would be freely birched in some schools or caned in others, and if the father dared to utter a word of remonstrance against an ordinary caning, he would be ridiculed by his old school-fellows and friends, repudiated by his own son, and rebuffed in any appeal to the laws. In the elementary schools, the work of maintaining discipline and morality is probably far more laborious than in the schools of the wealthy; surely, therefore, it is monstrous that a punishment freely allowed in the latter should be denied to the former—and this not by any recognised interpretation of the laws, but by an eccentric and capricious abuse of the power of a local magistrate!

In the infliction of all punishments, corporal or otherwise, the old and humane caution of Deuteronomy is ever to be present with us. There is to be a limit to the number of stripes, 'that thy brother may not seem vile unto thee.' The young teacher should bear this in mind in the infliction of metaphorical as well as literal stripes. We sometimes resort to reproach or sarcasm with a view of stimulating without punishing; and too often, without knowing it, we have exceeded the forty stripes and made our brother 'vile,' not perhaps in our eyes, but in the eyes of his schoolfellows and his own. That is a sad mistake. If we are to imbue boys with the spirit of morality, it is essential that they should count no one 'vile'; they must be taught to believe that there is some good in every one—some good even in the worst of their school-fellows. Whether they believe this or not will largely depend upon you; upon your faith in human nature and upon your power of manifesting that faith in action.

But it is time to pass from moral 'exercises' to moral 'rules.' I have omitted much that seemed inapplicable to day schools for young boys—organised school games, debating societies, school clubs, and the like. Any defects in this part of my subject will be supplied, I hope, by subsequent speakers. Let us come now to 'rules' and 'reasons for rules,' that is to say, direct teaching bearing on moral and civic duty. Under this head we may consider, first, what we teach at present, and whether we might teach that better; and secondly new means and methods of teaching.

Direct moral instruction, apart from that which is based on Scripture lessons, should not, I think, be given frequently, nor even regularly, least it should come to be taken as a matter of course and become stale and flat. The most impressive teaching of this kind can often be given in the way of warning, when something has gone wrong in the school. But it is not well, either, to delay giving one's pupils guidance till some of them have gone astray. At the beginning of each term the head master with the whole school, and class masters with their several classes, have an opportunity of giving direct moral instruction which is likely to have good and permanent results if masters can speak with conviction. The topics will be always open to variety of illustration based on the experience of the preceding term, but in themselves they will be always much the same. How the welfare and happiness of the whole school depend upon the good conduct of each member of it; how the disorder and mischievousness of a few may disturb and trouble the many; how unfairness, and cheating, and dishonesty in school work, as well as in other things, infect the atmosphere of the whole school, vitiate the relations between boys and masters, and drive away the spirit of frank confidence and friendliness which should bind all together; and how much a majority of well disposed boys might do by remonstrance and moral or other pressure to put down those mean and dishonest tricks which they ought no more to tolerate in school work than in school games—these subjects, term after term, will reappear, and may be so handled as to perceptibly improve the tone of the school for a time. Presently there will be a reaction, and another such lay-sermon will be needed—and the best of such sermons must never tempt the preacher of them to dispense with constant watchfulness or to imagine that they furnish a substitute for sympathy between teacher and pupil.

We all dislike—perhaps too much dislike—to warn boys beforehand against indecent and impure language and habits. It is a painful, but I fear a necessary, duty. But such warnings should be brief; and argument, I think, should have but little part in them. Boys may be told that impure words lead to impure deeds, which sometimes bring disease on body and mind, as well as on the soul; but, for the rest, I would no more argue with boys about the mischief of unclean language than about the mischief of dirty hands or faces. I have always, hitherto, held aloof from social efforts in this direction; and even now I intensely dislike the notion that purity requires a society to encourage it. But, if I were to begin a schoolmaster's life again, I think I should support, even in a day school, the formation of a society which had for its object the suppression of anything unseemly or indecent by remonstrance in the first instance; by social excommunication in the second; and, as a last resort, by reporting to the master.

I pass now to the teaching of the Bible, regarded as a means of moral training. All Christians confess that morality is based on the sense of brotherhood. The Bible is also confessed by all Christians to be a book in which God reveals Himself by

gradual stages as the Father of man, to whom He has proclaimed that they are His children and brothers one of another. One would have supposed, then, that the Bible, when placed in the hands of a teacher who recognises these fundamental truths, and who has also been trained to teach by gradual stages, would be confessed by all Christians to be the book above all others fittest to be a means of moral training. Yet there is a notion that in many elementary schools masters are hampered in teaching the Bible because they are forbidden to teach simultaneously disputed dogmas which they may believe to be deductible from it. 'By all means,' say certain people, 'the Bible is *the* book for moral teaching; but only if *we* teach it'—the 'we' representing always a small fraction, and often a very small fraction, of total Christendom. But do we not generally find that it is by vehement party politicians, or somewhat polemical ministers of religion, that these hampering difficulties of ours are so acutely felt for us, while we do not feel them ourselves? I venture to say, in the name of the great mass of masters of schools of the highest grade, and I believe I might go further and speak in the name of our united profession, that it is a source of strength and encouragement to us that, in giving Bible lessons, we are not compelled to make the Bible a basis for polemical theology, but are allowed so to teach it as to make its fundamental truths intelligible and applicable to the needs of daily duty.

There is, of course, the possibility that a teacher may be unable to accept as historical certain parts of the Bible which his pupils have to read under his supervision. That difficulty I appreciate from personal experience. But what competent teacher will feel bound to tell his pupils everything that he knows, or thinks he knows, on any subject, without considering whether the information is adapted for them? If anyone has a fair conception of the main spiritual truths underlying the development of humanity, and has realised how few these truths are, and yet how important for our well-being, how simple and yet how deep, and how much of varied and vivid illustration they require before they can be so impressed upon children as to influence their daily actions—he will, as it seems to me, find no more place in his Scripture lesson for disputed history than for disputed theology. 'My pupils'—I lately heard a teacher say—'believe anything I tell them in a Scripture lesson.' And so they do, no doubt, as long as you tell them about Noah, or Moses, or Adam and Eve, or Bethlehem and Nazareth, or the length of Jordan and the number of the Herods—or anything else that does not at present conflict with the experience of the class-room, the playground, the streets, and the home. But do they believe—I will not say in the literal sense, but in any sense whatever, so as to influence action—that 'it is more blessed to give than to receive,' or that we are to 'turn the right cheek' to him who has smitten us on the left? Do they believe—I will not say in the duty of loving enemies, but even in the duty of loving, or liking, boys who have done them no harm, and teachers who are labouring for their good? Has their attitude towards the first stranger whom they may meet out of school been in any way influenced by your Scripture lessons so as to be altered one jot from that barbarous temper which may be summed up in the words ''eave 'arf a brick at 'im'? If any can say 'yes'—as I feel sure that many can—they will be the first to admit that *their* great 'religious difficulty' has not been connected with any 'Conscience clause' or with any restriction on their religious teaching, or with any disputed dogma; their difficulty has been in quickening the consciences of their pupils to those simple and essential truths and duties about which no Christian can dispute.

Two suggestions, and no more, are all that time will permit me to offer concerning the method of Bible teaching.

One is negative. I should not even attempt to warn my pupils that it would not be right for them to drive a nail through Sisera, or hew Agag to pieces. Only make it clear to them that the Bible 'teaches by stages,' or, in the words of Jesus, that certain things were 'allowed for the hardness of the hearts' of men—and there will be no danger of their imagining that the morality of a Christian country is to be an exact copy of the morality of ancient Israel. But this can be done quietly without protesting that anyone is wrong. Never say that any interpreter or interpretation of the Bible is wrong. What have you or your pupils to do with what is wrong? You will only waste time. You may excite ill-will and suspicion among parents. You will often bewilder your pupils. Take example from the curate (afterwards an archbishop) who preached against the fool that said in his heart, 'There is no God.' The churchwarden, you may remember, confused the curate with the fool; and perhaps he was not far wrong. When teaching children, never waste time in refuting fools—or those whom you consider fools.

The next is positive. Unless there is some kind of proportion between God and man (such as is suggested by the saying that God made man in His image), the saying of Spinoza becomes true, that God may be no more like our conceptions of Him than the Dog Star is like a dog; and thus the Bible ceases to be a revelation, and Bible teaching becomes naught. But, if there is this proportion, then the Fatherhood of God may be illustrated by the fatherhood of men, and the Divine mercy, justice, and forgiveness by the best instances of mercy, justice, and forgiveness in humanity. I do not think any child can understand how God forgives unless he first understands how man forgives. Every teacher knows how a gutter by the roadside, with its cataracts and rapids and lakes and deltas, may be used to illustrate the phenomena of the Nile or the Mississipi; but we do not perhaps see with equal clearness that the simplest act of genuine human forgiveness may give some insight into that great process—similar in kind, though infinite and unique in degree—by which the human race is redeemed. With this recognition of proportion—or 'analogy of religion,' if we please—for analogy and proportion are but two names for the same thing—with this proportion in our minds, the teaching of the Bible becomes the teaching of spiritual law, directly applicable to the highest realisation of duty in the home and in the State. Then, while the Bible is a guide to life, life becomes a comment on the Bible; and, although many questions will always remain dark and insoluble as long as evil exists, yet the soul will wait patiently for fuller light, and, meanwhile, accepting all the truth it can assimilate, will be strengthened in that love of God and man which is the only basis of true morality.

I pass to civic training. As the basis of morality is the love of our neighbour, and knowledge of its needs, so the basis of civic training must be love of the community and knowledge of its needs. It is obvious that history might be so taught as to stimulate the love of the State, and to increase the knowledge of its needs; but I fear that recently it has been in many schools scarcely taught at all. At least, I can remember, two or three years ago, that a fairly intelligent boy from an elementary school, well trained in arithmetic and geography, told me that he did not know any history, and gave, as his reason, that 'he had not learned it at school.' And in the Education Blue Book of 1886-87 I find a chorus of complaints from Inspectors lamenting that, in consequence of some regulations of the Code, 'history has died a natural death.' I believe that subsequent changes in the Code have swept away these monstrously absurd regulations. If they have not, it is a mockery to speak to teachers about civic training. How can children do their duty to their country if they do not love it, and how can they love it if they know nothing about it? To neglect the study of our national traditions is surely to smooth the path for national discord and disastrous revolution. If, as children, our pupils do not learn that time, and effort, and patience, and mutual forbearance between class and class, are needed to make and develop a great country, are they likely, when they reach manhood, to resist the tempting belief that all grievances can be removed by statute, and that, in order to produce a perfect political constitution, we want nothing but ink and abundance of paper? The ideal condition is, that the study of national history should be a kind of domestic worship in which the fathers teach the children, so that, as the younger generation grows up, they can say with literal truth, 'We have heard with our ears, and our fathers have declared unto us, the noble works that thou didst in their days, and in the old time before them.' But in modern times teachers mostly do this work for fathers. In any case, whether by fathers or by teachers, or by books or newspapers, the work must be done, if the rising generation is to receive anything worthy of the name of civic training.

Do we need new text-books in order to teach history in this way? Not so much new text-books, perhaps, as new examinations. Children ought to be examined in pictures, or in picturesque events, rather than in a continuous stream of facts. Here is a picture of our country that was instructive to a great German writer: 'What the note of British freedom means'—says Heyne—'I never really understood till the other day, when I saw an English vessel sailing past when it was blowing big guns, and listened to the crew on deck, whose voices rose above the roar of wind and wave, as with almost impious defiance they shouted the ancient strain of "Rule Britannia, Britannia rules the waves."' It would be easy to devise a score or two of pictures—word-pictures, if painted pictures cannot be had; but painted pictures, fit for a large lecture-room, would be by far the best—which might take a child backward from the present time to the days of 'the crows and the kites,' as Milton calls them, and which would leave upon a child's mind absolutely indelible impressions of the grandeur and growth of the destinies

of our great empire. Taught thus, with the aid of geography (which is in itself a picture), history ought to be one of the most vivid and inspiring of subjects, and might directly conduce to civic morality. Moreover, if these pictures, on their first presentation, were definitely associated with their dates, the thirty or forty dates thus acquired would be retained easily and permanently, and would afford a useful scaffolding for the subsequent fuller study on the part of the older and abler pupils. But, in order that all this may not be spoiled by examinations, the Inspectors must be allowed to deal with this subject as they are allowed (I am glad to say) in London to deal with the Bible, not exacting knowledge of minute details, but an intelligent appreciation of 'the Story of the Empire.'

Now, besides teaching history in such a way as to inspire patriotism, can we do anything further in our schools in the way of civic training? And for this purpose do we need a separate text-book, or may we trust to our oral comments on the history lesson? And if we need a new text-book, on what lines ought it to be written? And ought this book to include any hints or rules on private as well as public morality?

I think such a book would be useful, but it ought to be a manual rather than a catechism. Civic duties are, for boys, prospective duties; and a catechism of prospective duties is like a book of rules without exercises, apt to be learned mechanically, and worse than no book at all, because it takes away the appetite for knowledge. A civic catechism might tend to make boys slightly hypocritical, or, to put it briefly, prigs. But a civic manual would deal in facts—facts suggesting precepts certainly, but not precepts themselves—and these facts might be made interesting as well as useful.

Take, for example, the subject of indiscriminate alms-giving. A few words on this point might fairly find a place in a comment on the words of Scripture, 'Give to everyone that asketh thee'; but the evil is great enough to demand fuller treatment, and perhaps a short sketch of the evils that are known to have resulted from this habit in past times, together with an account of the working of the English poor law in this century, might be made intelligible even to the young.

I think, also, that some explanation is needed of the rule that we are to do to others as we would wish that they should do to us. When a whining rascal puts forward this plea to escape well-merited punishment, it is not uncommon for kindly sentimentalists either to diminish the penalty or to feel uneasy and unchristian in inflicting it, whereas the true, and right, and Christian answer is this: 'If I had done the mischief you have done, and if I knew what was best for me, I should know that I had deserved punishment, and should endeavour to bear it without complaining.' In this connection a short but clear account should be given of the great virtues of justice and resentment (to be carefully distinguished from severity and vindictiveness) which have fallen into discredit of late with many worthy people, owing to an effeminate perversion of the letter of certain Christian precepts.

I recently read in the speech of some prominent politician that 'the most laudable ambition' for a working-man was to provide for the comfort and happiness of himself and his family. I should think that there was a mis-print somewhere; but even if we substitute 'a' for 'the,' we can hardly deny that 'ambition' is a mistake, and not a mis-print for 'desire'; and some may think that 'laudable' is a mistake for 'natural.' I think, in our Manual of Moral and Civic Training, some modernised version of the old fable of 'The Belly and the other Members' should find a place; and it might be impressed even upon the youngest that if, in any community, it were regarded as 'the most laudable ambition' in any individual to provide for himself and his family, such a community and such an individual would have an extremely useless, contemptible, and probably, in many cases, a short existence. Æsop's fable is reproduced, on a sublime scale, in St. Paul's Epistles; but St. Paul's Epistles are difficult reading for young boys; and, though the teacher will do well to bear in mind the Pauline version, the manual should reproduce Æsop's original.

Æsop's fable contains, perhaps, the earliest account of a 'strike.' The hands and mouth, if you remember, conspired with the other members to 'strike' against the belly. Shall we point this out in our manual, or shall we avoid it as a 'burning question'? I think we ought not to avoid it; but, if we touch upon it, we must be strictly impartial. On the one side we must show how our ancestors altogether suspected and prohibited competition, how they limited and hampered both labour and capital; how capital emancipated itself first; how labour then fought for, and gradually obtained, its rights, and how we have thus by degrees now come to a point where both are free, and both likely to ruin one another, unless they agree to submit their differences to arbitration—a conclusion which perhaps may be pointed by another Æsopian story which tells how the fox stole away the prey for which the lion and the tiger had been fighting till they had half-killed each other.

But questions that are really 'burning,' and unnecessary, or premature, must of course be avoided. Two or three years ago I opened what appeared to me a very good book upon civic duty, intended for the young, which told the children that we are 'at present under a monarchy.' Even if I were a red-hot Republican, I should still, as a teacher, think that this was an unpardonable mistake. Teach children, by all means—calling to your aid both fact and fable—that states, like trees, grow and develop, and that the best kind of political changes are those which imitate Nature, who 'innovateth greatly, yet by degrees, so as scarce to be perceived'; but do not unsettle the minds of a small minority, do not utterly bewilder the vast majority of your pupils, by throwing out enigmas of this kind, which, if understood, would be regarded by many parents as a breach of good faith on the part of the teacher.

While we teach children that states grow, should we not teach them also how and why states decay? No doubt, something of this teaching can be given when one is explaining to children the meaning of the Fifth Commandment. Even the youngest can see that their days are not likely to be 'long in the land' unless they give some heed to their parents; and older children can easily realise that this applies to countries as well as to individuals, and that reverence for elders, and for the traditions of elders, is one of the first guarantees for the permanence of a nation. But then we must add that other things besides irreverence destroy nations. Jobbery and corruption and all the other evils that spring up in trades, in professions, in church, in state, from the excessive and not always 'laudable ambition to provide for the happiness and comfort of oneself and one's family'—these might be briefly but vividly described and traced in some of their more definite results as leading to the paralysis of trade, the defeats and disasters of armies, the degradation of art, the perversion of justice, the lowering of the national tone and character, the pollution of Government and the introduction of anarchy followed by despotism. But if these matters are to be put before children, they must be illustrated—or perhaps I should say expressed—by historical facts which must be left to speak largely for themselves, nor must there be omitted some mention, however brief, of that neglect of the laws of health and temperance and morality, which shortens and enfeebles the lives, both of the fathers who neglect them, and of the children, even to a remote posterity, who pay the penalty for a neglect that is not their own. There is too great a tendency to exult in the vast future of the English-speaking races simply because our numbers promise to be vast; and very vast, no doubt, seemed the army of Sennacherib on that night when it lay down to rest before the walls of Lachish; but there was pestilence in the air. And with us, too, there are threatening signs of moral pestilence.

Ought our manual to do anything to aid our history lessons by stimulating patriotism? And, if so, how can this be done? 'Let me make the songs of a country,' said a wise man, 'and then who will shall make its laws.' But, alas, where are our songs? The very happiness and prosperity of our country place us here at a disadvantage. The flower of our youth has never perished on their native soil contending for its liberties against a foreign foe, and therefore not many poets have been inspired to bequeath us literary legacies of undying memorial of these who have given their lives for their country. Such as we have might at least be collected together with the far more numerous prose narratives of patriotic or public-spirited exploits—not military alone. We might hope they would be too numerous to form a part of our short manual, but might constitute a book by themselves—a 'Book of Noble Deeds.' Many such books, I should think, exist already, and in these, or in some combination or modification of these, there might be found the right book.

The manual will, of course, include several chapters describing 'How we are Governed,' and perhaps an outline of the principles of our laws, which will be interesting to at least the older boys. But ought it not also to include a chapter on 'How to be useful,' showing a boy how he may be of use sometimes in cases of fire, or accident, or other emergency, by knowing exactly what to do, or when and how to do it? Is it not a good training, a preparation for, if not almost a part of, civic training, that a boy should be taught to observe where the nearest fire station is, the hospital, the post-office, the police-office, and the like, in order that he may be at least able to answer questions from strangers in want of information, or to

give practical help in time of need? I would go still further, and add a short and simple chapter—not printed, perhaps, but oral—on 'How to behave in Public,' which should find room for simple precepts (with reasons, of course) such as these, 'Keep to the right on the pavement'; 'Do not throw orange-peel about in the streets and paper about in the parks'; 'Keep out of a crowd, unless you can do some good in it'; 'Do not put your boots upon the seat opposite you in a railway carriage'; 'Do not talk so loud to your school-fellows in public as to annoy strangers.' These are small things, very small things; but they are at least things, not mere airy words; and they may be a preparation for greater things. I make no apology for calling your attention once more down to these minor matters at the conclusion of my remarks. The love of our neighbours, individually and collectively—that indeed it is with which we desire to imbue our pupils; and that is the very altar of morality. But one goes up to an altar by steps. And, as a first step towards loving one's neighbour, it is not amiss sometimes for a child to learn not to make himself a nuisance to his neighbour.

I have only one other suggestion to make. It has always seemed to me Moses was truly wise and inspired in instituting national holidays to commemorate national deliverances. We have sacred holidays, with more or less trace of sacred associations; and we have 'bank holidays.' Our cousins on the other side of the Atlantic have followed in the path of Moses. They think, and rightly, that they have much to be thankful for, and they have instituted days to express their thankfulness. But have we not also, we who join hands in a family circle of freedom round the world, much reason for being thankful? If one day in the year were set apart as Thanksgiving Day for the English speaking races throughout our Empire, I should not indeed expect that the millions of toiling fathers would on that day resort much to church or chapel; but, on the eve of Thanksgiving Day, I should feel sure that every teacher worthy of the name would welcome the opportunity of declaring to the children, to whom he stands in this respect as a parent, the 'noble works' that God has done for our nation in our days and in the old time before us, and would not omit some reference to the 'noble works' that are still in store for us, if we follow in His path of righteousness. Such lessons, so given, would greatly stimulate the minds of children, and might in time become a perceptible power working in our country for unity, and strength and civic morality.

Notes on the Annual Conference of the National Union of Teachers.

THE Annual Conference of the National Union of Teachers, held in London during Easter week, proved of a decidedly practical character. The chief aims of the Union—the progress of education and the good of the educator—were, in every part of the work, kept steadily in view, and resolutions were adopted which, if carried into effect, would revolutionize the state of affairs at present existing.

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The address of the President (Mr. H. J. Walker, late of the Temple Colston Schools, Bristol, and now a member of the Bristol School Board) dealt chiefly with the New Code, which he accepted as evidence of a desire on the part of the Department to improve education, but with reservation of right to criticise details; with irregular attendance, and the necessity for more stringent application of compulsion; with the necessity for superannuation of teachers, and with the benevolent work in which the Union is engaged. The address was eminently practical, of moderate length, and educational in its tone and spirit.

Every teacher in the country should read the paper on *Civic and Moral Training* which Dr. Abbot, formerly Head Master of the City of London School, prepared for the conference. He will find in it a confirmation of the views which have been urged repeatedly on the Department by the Union, a repudiation of the doctrine that a teacher brutalises a boy by the use of the cane, a strong plea for the use of the Bible as a text book of morals, and a condemnation of the methods of examination in history, as tending to destroy or prevent the good which proper tuition might do. The paper seemed to please the Conference greatly, and it proved one of the good features of the annual gathering.

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A good discussion took place on the New Code. Abuses die hard, and in this country reforms are adopted but slowly and then only piece-meal. The Code is an advance on its predecessors, and thanks to the Deportment were given for the changes made, but regret was expressed respecting several points both in the Code and the instructions to Her Majesty's Inspectors. Objections were taken to the retention of the merit grant in infant schools, the publication of school accounts and reports, the necessity for presenting children of seven years of age in the first standard, and of each child going up a standard every year, to the variable discipline grant as a merit grant in disguise, and the various clauses which restrict the teacher in the classification of his scholars.

The conference reiterated its former dictum, that payment by results should be entirely abolished, passing a resolution approving cordially of a motion to that effect now before the House of Commons.

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Another of the subjects fully dealt with was that of Half-Time Schools and their difficulties. Resolutions passed called for a direct recognition of these difficulties in the instructions to Her Majesty's Inspectors, to the necessity of age and attendance being the only passports to labour, and one more drastic still, for the abolition of half-time altogether, as prejudicial to national progress and the best interests of education.

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The progress of education and the well-being of the educator are inseparably connected. In striving to better the condition of the teachers, the conference is helping forward education. A provision for old age is a great inducement to contentment in the present. For many years the Union has desired a scheme of superannuation. Definite steps were agreed upon to procure the passing of an Act of Parliament to superannuate teachers on the principle of a deduction from salaries, the solvency of the fund to be guaranteed by government. The scheme is to apply to all teachers throughout the country.

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The complete fulfilment of the promises of the government to teachers at work before 1862 was again demanded. The efforts made in the past have resulted in great gain to the profession. Upwards of £100,000 has been obtained as the result of the persistent agitation since 1870. No better test of the utility of the organisation couldtbe desired.

Subjects upon which the opinions of teachers are hopelessly divided have been avoided. Several attempts to discuss the subject of free education, which occupied a place on the agenda, were made, but the majority of the conference prevented its being brought forward. As it has ceased to be a political question, its principle having been adopted by both parties, a discussion might have been of service as showing the effect of its adoption on various classes of schools.

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Deputations visited the conference from Ireland, Scotland, and Belgium. These interchanges of opinion serve a very useful purpose and lead to united action on all subjects affecting the general body of teachers. The National Union sends delegates to each of these countries at their annual gatherings.

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Among the more social functions of the Conference were the meeting at the Mansion House in favour of the Teachers' Charities, the Conversazione at the South Kensington Museum, placed at the service of the Union by the Lord President of the Council; an assembly at Cannon Street Hotel; various reunions of old college acquaintances, and excursions to places of interest in and around London. The practical outcome of these gatherings is a greater interest in the work of benevolence, a strengthening of *esprit de corps*, and a general broadening of view, and extension of liberal sentiment.

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The whole conference proceedings partook of a practical character, they were conducted with ability, despatch, and freedom from frivolity and narrowness of view. They tended to increase the power of the teachers in the country, and to illustrate the benefits to be derived from the union of those whose interests are identical. The London press paid greater attention to the Conference than on any former occasion, and all the principal provincial papers were represented in the Conference. Education will gain, and the teachers also, from the Conference of 1890.

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Below we give a list of Publishers and their representatives. All seem agreed that the Exhibition this year was the best ever held.

PUBLISHERS	REPRESENTATIVES
Arnold, E. J.	Messrs. S. R. Ward and H. Wood.
Bacon, W. G.	Messrs. Jolly and Willmott.
Bell, G., & Sons	Mr. J. Colman.
Bemrose and Sons.	Mr. F. Clayson.
Blackie & Sons, Limited	Messrs. Castell, Smith, King, and Ellson.
Blackwood & Sons	Messrs. J. and W. Tidmarsh.
Bradbury & Winterbottom	Mr. D. Winterbottom.
Brown, W. G.	Mr. W. G. Brown.
Cassell & Co.	Messrs. Jackson, Westmacott, and Baskerville.
Chambers, W. & R.	Messrs. McHardy, G. L. and T. H. Hodges.
Clay, C. J., & Sons	Messrs. Boning and Hamilton.
Clive, W. B., & Co.	Mr. S. W. Heaton.
Collins, Wm., Sons & Co.	Messrs. A. Pitkethley and Ross.
Cresswell, Ball & Co.	Mr. Cresswell.
Curwen, J., & Sons	Messrs. Whitty and Betts.
Dawson, A. G.	Mr. E. H. Daish.
Educational Musical Instrument Company.	Mr. W. H. Brooks.
Educational Supply Association	Messrs. H. L. Williams, Waight, and Webber.
Eyre & Spottiswoode	Mr. Theo. C. Baxter.
Frankies, A.	Mr. A. Frankies.
Frowde, H.	Mr. Bennett.
Gill, Geo., & Sons	Messrs. B. Jonson and G. Slater.
Hammond, D.	Mr. C. Davy.
Hibbert, Mrs. A.	Mrs. Hibbert.
Holden, A. M.	Mr. A. M. Holden.
Holmes, J. F.	Mr. J. F. Holmes.
Hughes, Joseph	Messrs. H. Scheurmier, A. Figg, and Thos. L. Hughes.
Isbister & Co.	Messrs. Moulton and Heller.
Jarrold & Sons	Messrs. Averill and Winter.
Johnston, W. & A. K.	Mr. Jas. Walker.
Johnston, A.	Mr. Wash.
Lambert, Messrs. E. & A.	Miss S. Williams.
Lewell & Cartwright, Messrs.	Mr. W. A. Lewell.
London Educational Depôt	Messrs. Gomme, Churchill, Litting, and Birch.
London Scholastic Piano and Organ Company	Mrs. M. A. Jones.
Longmans & Co.	Messrs. Greenway, Allen, Bennett, and Lane.
Macmillan & Co.	Mr. Shallis.
Marcus Ward & Co.	Mr. G. Robson.
Marshall, J., & Co.	Mr. Perry.
National Society's Depository	Messrs. Hamilton and Badrick.
Nelson, T., & Sons	Messrs. H. Gibbs and Kenworthy.
Philip, G., & Sons	Messrs. Taylor and Hatch.
Ruddiman Johnston & Co.	Mr. Bogie.
Sampson Low & Co.	Messrs. J. K. Lewis and F. J. Rymer.
School Books Publishing Company	Messrs. J. W. Thomas and E. Taylor.
Smith & Son	Mr. E. W. Collins.
Stanford, E.	Messrs. Moulton and Heller.
Spratling, J. R.	Mr. J. R. Spratling.

Publications Received.

BACON, G. W., & Co.—Relief Maps—England and Wales, Europe; Standard Diagrams—Sheets 4, 5 and 6.

BLACKIE & SON.—The Century Arithmetics, Standard 5; Vere Foster's Bold Writing Series, Nos. 13½ and 15½; Blackie's Science Text Books—Light, Heat, and Sound (*Dr. Draper*); Magnetism and Electricity (*W. Jerome Harrison and C. A. White*).

CASSELL & CO., LTD.—Work, 1890 (Edited by *Francis Young*).

CLIVE, W. B., & Co.—University Correspondence College, Tutorial Series:—History of Sicily (*Allcroft and Masom*); Cicero de Finibus I (*Moses and Fearenside*); Horace Odes, Book II. (*Allcroft and Hayes*).

CURWEN, J., & SONS.—School Cantatas: The Wood Witch (*Foxwell and Forchhammer*); Medburn Musical Drill (*Farrington*).

FISHER UNWIN, T.—The Century Magazine—April and May.

GOTCH AND GOMME.—The Music Student's Examiner (*J. Cliff Wade*); Graduated Stories for Composition (*Ellery*).

LONGMANS & Co.—Longmans' Handbook of English Literature, Part 4 (*R. McWilliam, B.A.*); Longmans' Supplementary Readers for Standards 1, 2, 3 and 4;' Advanced Physiography (*Thornton*); Longmans' New Arithmetics, Books 1 to 6, and answer books.

MACMILLAN & Co.—Shakespeare's Macbeth (*Deighton*).

NELSON, T., & SONS.—Lower Grade English; The Royal Atlas Readers Nos. 1, 2, 3, 4, and 5.

SAXON & Co.—Everybody's Pocket Cyclopædia.

SIMPKIN & Co., LTD.—The Practical Guide to Perspective (*J. P. Knight*); English Composition (*Thomson*).

SMITH, ELDER & Co.—Cornhill Magazine—April.

WARD, LOCK & Co.—Lippincott's Magazine—April.

THE TAILOR.

(The Practical Teacher Prize Action Song.)

Words by J. FINNEMORE. *Music by* R. DUNSTAN, *Mus. Bac., Cantab.*

mf. Symph.
Voices.
(In Moderate Time.)
The tai - lor sits (1) on his ta - ble high, With his
*KEY B♭.
legs crossed un - der, (2) so!..... With nee - dle and thread (3) he earns his bread, As his fin - gers come and go,..... As his
fin - gers come and go, ... When a customer comes who wants some clothes He measures (4) with tape so long, ... And
then in his book (5) he can al - ways look, For fear he should go wrong,..... For fear he should go wrong. .....

He spreads (6) the cloth upon the board,
And takes his (7) scissors bright,
He snips (8) and snips, till out he clips
The shape both neat and right;
Then up he climbs, and folds (9) his legs,
And on, his (10) thimble goes,
And now he'll place, with careful face,
His glasses (11) on his nose.

He draws his thread with steady hand (12)
From out the tangled skein,
To make it tough and strong enough
He waxes (13) it amain;
He holds his needle (14) to the light,
And slips the thread (15) in straight,
And well he knows, as fast he sews, (16)
His work must ne'er be late.

When all the stitching's done, he puts
His irons (17) to the fire,
His goose (18) he plies, each wrinkle flies,
His busy arms ne'er tire;
Then neatly will he fold (19) the clothes,
And tie (20) the parcel tight,
He's done his best, and now he'll rest
With heart so gay and light.

ACTIONS.—(1) Hold hands up, with palms horizontal. (2) Imitate with arms the manner in which a tailor folds his legs. (3) Imitate a tailor sewing, notice that the arm is thrown directly outwards—cobbler fashion—instead of up and down. (4) Imitate unrolling tape measure. (5) With left hand held open in front, imitate writing on it with right fore finger. (6) Spread hands out as if smoothing cloth. (7) Imitate slipping fingers into bows of scissors. (8) Use scissors. (9) Repeat 2. (10) Imitate slipping on thimble. A tailor uses a headless thimble thrust on the little finger. (11) Adjust imaginary spectacles. (12) Keep left hand fixed and slowly raise right hand. (13) Wax thread. (14) Hold up needle. (15) Thread it and draw thread through. (16) Repeat 3. (17) Slightly bend and put hands down as if laying iron to fire. (18) Imitate ironing. (19) Imitate folding clothes. (20) Draw imaginary string tightly round a parcel.

* In Infant Schools where only one part is taken, this song should be a tone lower, in Key A♭.

Query Column.

RULES.

1. **Each correspondent is restricted to *one question*.** We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. **☞ When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.**

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher, Pilgrim Street, Ludgate Hill, London, E.C.*

Science.

1. EXCELSIOR.—If W be the weight of a body in pounds, what assumptions are made and what units are referred to in obtaining the expression $\frac{W}{g}$ for the mass of the body.

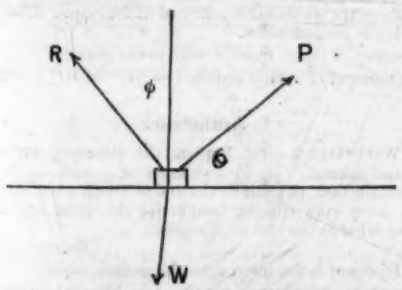
A body of known weight is placed on a rough horizontal plane and pulled in a certain direction; find (1) the force of the pull which will just make the body slide, and (2) what must be the direction of the pull that it may be the *least* that will make the body slide?

Suppose that P is the least pull, as above determined, and suppose that the body when pushed by a force P_1, acting along the same line as that along which P acted, is on the point of sliding, show that $P_1 (1 - \mu^2) = P (1 + \mu^2)$, μ being, of course, the co-efficient of friction.

(*Theoretical Mechanics, Science and Art*, 1881.)

If W be the weight of a body in pounds, in stating that the mass of the body is $\frac{W}{g}$ we assume the equation Force = mass × acceleration, and we take the weight of a pound of matter as our unit of force, measuring the acceleration in ordinary units of feet per second. The unit of mass is chosen so as to make the above equation true, and therefore the mass of 1 lb. on this system is represented numerically by $\frac{1}{g}$ or the unit of mass is g lbs.

These units are called gravitation units.



In the part of the question involving friction. When motion is just about to take place the reaction of the plane is inclined at the limiting angle of resistance to the normal.

Let ϕ = limiting angle
R = resultant

Resolving vertically we get

$$W - P \sin \theta = R \cos \phi \quad (1)$$

And resolving horizontally

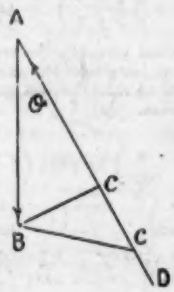
$$P \cos \theta = R \sin \phi \quad (2)$$

Dividing (1) by (2)

$$\frac{W - P \sin \theta}{P \cos \theta} = \cot \phi = \frac{1}{\mu} \quad (3)$$

Therefore $$P = \frac{\mu W}{\cos \theta \times \mu \sin \theta}$$

To find the minimum force required: We have the direction and magnitude of W fixed, and the direction of the resultant makes an angle ϕ with the vertical when motion is just about to commence.



Let AB represent W in magnitude and direction, and AD be inclined at the angle ϕ to AB to represent the direction of R. Complete the triangle by any line BC, then the forces represented by AB, BC and CA are in equilibrium, and BC represents P in magnitude and direction. But since B is fixed, BC is least when it is perpendicular to AD as at BC^1. If θ = inclination of BC to the horizontal $\tan \theta = \tan \phi = \mu$.

The following is another proof:—

From (3)

$$\frac{W - P \sin \theta}{P \cos \theta} = \text{cotan } \phi$$

$$W = P \cos \theta \cot \phi + P \sin \theta$$

Therefore $W \sin \phi = P (\cos \theta \cos \phi + \sin \theta \sin \phi) = P \cos (\theta - \phi)$

Now W and $\sin \phi$ are constant.

Therefore P is least when $\cos (\theta - \phi)$ is greatest, or when $\theta = \phi$.

If P^1 act in an opposite direction to P and the body is about to slide.

We have

$$\frac{W - P \sin \theta}{P \cos \theta} = \frac{1}{\mu}$$

$$\frac{W + P^1 \sin \theta}{P^1 \cos \theta} = \frac{1}{\mu}.$$

Therefore $$W - P \sin \theta = \frac{P \cos \theta}{\mu}$$

and $$W + P^1 \sin \theta = \frac{P^1 \cos \theta}{\mu}$$

Subtracting, we have:—

$$(P + P^1) \sin \theta = \frac{(P^1 - P) \cos \theta}{\mu}$$

$$(P + P^1) \tan \theta = \frac{P^1 - P}{\mu}$$

But $\tan \theta = \tan \phi = \mu$.

Therefore $(P + P^1) \mu^2 = P^1 - P$

$$P (1 + \mu^2) = P (1 - \mu^2).$$

2. IVANHOE.—When a body is immersed in a fluid, how do you distinguish between the whole fluid pressure, and the resultant fluid pressure exerted on it?

A thin rod of uniform density weighing 1,000 grains, whose specific gravity is $\frac{1}{2}$, has a weight, which is to be treated as a point, fastened to one end. Show that if the weight is sufficient to make the rod float *vertically*, it must not be less than 225 grains.

If the weight were less than 225 grains, why are the above data insufficient for determining the position in which the body will float? (*Science Exams.* 1876.)

The whole pressure of a fluid on a body immersed in it is the sum of all the normal pressures exerted by the fluid on every portion of the surface. The resultant pressure is the resultant of all these normal pressures, and in the case given is equal to the weight of the displaced water, and acts in a vertical line through the centre of gravity of the displaced water.

In the above example let:—

l = length of rod

w = weight applied to bottom of rod to sink it

y = part of rod immersed in water

Then $y = \frac{2}{3}l + \frac{2}{3}\left(\frac{w}{1000}\right)l$ (1)

$w\frac{y}{2} = 1000 + \left(\frac{l}{2} - \frac{y}{2}\right)$ (2)

For the rod just to float vertically the centre of gravity of the rod and weight must be just below the centre of gravity of displaced water. Hence w must be just greater than the value given by above equation. (2)

Eliminating y we get

$$w\frac{1}{3}l\left(1 + \frac{w}{1000}\right) = 1000\left(\frac{1}{2} - \frac{1}{3} - \frac{w}{1000}\right)$$

$$\frac{w^2}{3}\left(1 + \frac{w}{1000}\right) + \frac{1000}{3}\left(1 + \frac{w}{1000}\right) = 500$$

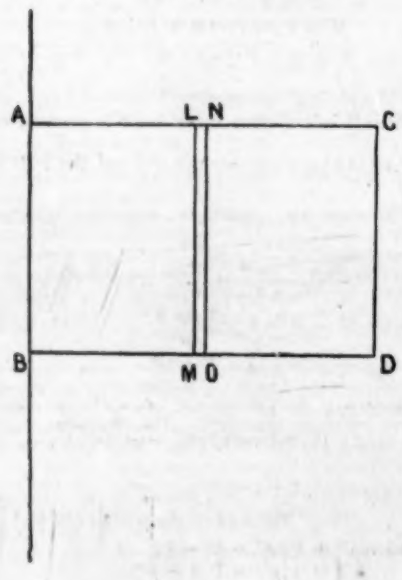
$$(w \times 1000)^2 = 1{,}500{,}000$$

$$w \times 1000 = 1224{\cdot}7$$

$$w = 224{\cdot}7 \text{ grains.}$$

If w be less than this we require the dimensions of the cylinder to be able to find when the centre of gravity of the displaced water and of the weighted cylinder are in the same vertical line.

3. R. W.—Find the *moment of inertia* of a rectangular lamina, *first*, with respect to one edge; *secondly*, with respect to a diagonal. A fine wire of uniform thickness is bent into the form of a circle, whose radius is r; find its *moment of inertia* with respect to an axis passing at right angles to the plane of the circle through a point in the circumference.



To find the moment of inertia about the edge AB.

Let AB = a

AC = b

m = mass of unit area of rectangle.

Consider any elementary area LO of thickness dx at a distance x from AB.

Then area of LO = adx.

mass of LO = $madx$.

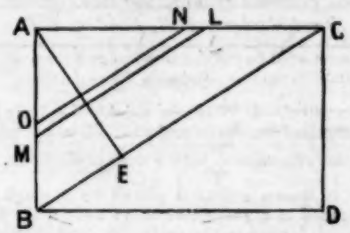
Moment of inertia of element = $madx \times x^2$.

$\therefore$ Moment of inertia of rectangle $= \int_0^b max^2dx$

$$= \frac{mab^3}{3} = \frac{Mb^2}{3},$$

where M = mass of the whole rectangle.

To find moment of inertia of rectangle about the diagonal BC



Draw AE at right angle to BD. Let AE = e, BC = f.

Consider any elementary area MN bounded by lines parallel to BC, breadth of element dx. Perpendicular distance from BC = x.

Then area of element $= \frac{e - x}{e} f dx$

Mass " " $= m\frac{e - x}{e} f dx$

Moment of inertia about BC $= m\frac{e - x}{e} f dx \times x^2$

And moment of inertia of the rectangle ABCD $= 2\int_0^e \frac{e + x}{e} mfx^2dx$

$= \frac{mfe^3}{6} = \frac{Me^2}{6}$ where M is the mass of the rectangle.

With respect to the last part of the question. The moment of inertia about an axis through a point in the circumference perpendicular to the plane of the circle is equal to the moment of inertia about a parallel axis through the centre plus the moment of inertia of the whole mass collected at the centre about the axis through the circumference.

Therefore, if M = mass of wire in the circle

The moment of inertia required = $Mr^2 + Mr^2 = 2Mr^2$.

Arithmetic.

1. WILL DAVIS.—(*a*) Explain the difference between discount and interest. (*b*) Five volumes of a work can be bought for a certain sum, payable at the end of a year; and six volumes of the same work can be bought for the same sum in ready money; what is the rate of discount?

(*Barnard Smith.*)

(*a*) Discount is the interest on the present worth.

Interest is the interest on the debt, that is, on the present worth and discount.

(*b*) Rate of discount = ($\frac{1}{6}$ of 100) per cent.

= $16\frac{2}{3}$ per cent. Ans.

2. M. R.—The incomes of A and B are in the proportion of 7 to 9, and when the income-tax is at the rate of 5d. in the pound, B pays £9 1s. 3d. more than A. Find A's income.

(*Certificate Exam., 2nd Year, Females, Scotland, 1888.*)

Income for difference in tax = (£9 1s. 3d. $\div$ 5d.) £

= (2175 $\div$ 5) £

= £435;

Difference in incomes = $\frac{9 - 7}{7}$ or $\frac{2}{7}$ of A's income,

$\therefore$ A's income = £435 $\times \frac{7}{2}$

= £1,522 10s. Ans.

3. F. F.—A player loses $\frac{1}{3}$ of his money and then gains 10s. He next loses $\frac{1}{4}$ of what he now has, after which he gains 3s. If he now has 3 guineas, how much had he at first?

(*McDougall's Standard VII. Cards.*)

Amount before last gain = £3 3s. − 3s.
= £3;
,, ,, loss = £3 × $\frac{4}{3}$
= £3 15s.;
,, ,, first gain = £3 15s. − 10s.
= £3 5s.;
,, ,, ,, loss = £3 5s. × $\frac{4}{3}$
= £16 5s. ÷ 4
= £4 1s. 3d. Ans.

Note.—The answer given is incorrect, as in that case he would have £3 15s. at last.

Algebra.

1. ELEVE.—A regiment has sufficient food for m days; but if it were reinforced by p men, would only have food enough for n days; find the number of men in the regiment.

Let x = number of men in the regiment,

men men days days

Then $x + p : x :: m : n$,

$\therefore n(x + p) = mx$

$nx + np = mx$

$np = mx - nx$

$(m - n)x = np$

$\therefore x = \frac{np}{m - n}$,

$\therefore$ Number of men in the regiment = $\frac{np}{m - n}$.

2. W. G.—Show how to find the time in which a sum of money will double itself at compound interest.

Let P denote the principal in pounds, n the number of years, R the amount of one pound in one year, and M the amount at compound interest.

Then $M = PR^n$,

$2P = PR^n$,

$2 = R^n$,

$\therefore n = \frac{\log 2}{\log R}$.

$\therefore$ Time = log 2 ÷ log. of amount of one pound in one year.

3. CHARLES.—A train 200 yards long passes another train 240 yards long, moving in opposite direction on parallel lines, in 12 seconds; if they had been moving in the same direction they would have cleared each other in one minute; find the rates per hour of the two trains.

Let x = Rate per second of 1st train in yards,

And y = ,, ,, 2nd ,, ,,

Then (1) $\frac{200 + 240}{x + y} = 12$

(2) $\frac{200 + 240}{x - y} = 60$

(1) $110 = 3x + 3y$

(2) $110 = 15x - 15y$

(1) $15x + 15y = 550$

(2) $15x - 15y = 110$

$30x = 660$

$\therefore x = 22$.

$30y = 440$

$\therefore y = 14\frac{2}{3}$.

$\therefore$ Rate of 1st train per hour = $\frac{22 \times 60 \times 60}{1760}$ miles

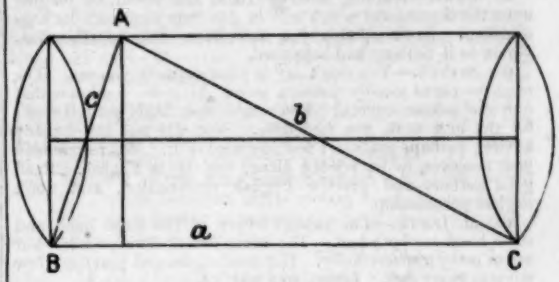
$= 45$ miles;

,, 2nd ,, ,, = $\frac{44 \times 60 \times 60}{3 \times 1760}$ miles

$= 30$ miles.

General.

1. RALPHO.—Three cylinders being supposed to pass through the three vertices, and to have for axes the three opposite sides of a rectilineal triangle, show that their three curved surfaces are equal in area. (*Intermediate*, 1879.)



Let ABC be a triangle.

Let perpendiculars from A, B, C on opposite sides = $2p_1$, $2p_2$, $2p_3$.

$\therefore p_1a = p_1b = p_1c$ = area of triangle.

But area of cylinder passing through ABC with an axis = BC or a is $2\pi p_1 a$.

Similarly the area of cylinder passing through BCA with an axis = CA or b is $2\pi p_2 b$; and area of cylinder passing through CBA with an axis = BA or c is $2\pi p_3 c$.

Now these are all equal, since $p_1a = p_2b = p_3c$.

Hence the curved areas are equal.

2. T. P. M.—A hard mass weighing 50 lbs. falls from a height of 6 feet on to a plane surface, which at the instant of greatest compression has yielded to the extent of $\frac{1}{10}$ of an inch—the mass itself being supposed to be entirely uncompressed; determine the duration of compression, supposing it produced by the *mean* pressure.

(Twisden's *Practical Mechanics*, *Ex.* 822.)

Here the energy of the ball at the instant of contact is $50 \times 6 \times g$ units of work. This work is done against a force R acting through $\frac{1}{10}$ of an inch.

Hence if R is constant we have

$50 \times 6 \times g = \frac{1}{20 \times 12} R$

$\therefore 300g = \frac{1}{120} R$,

$\therefore R = 72{,}000g$ absolute units.

Now $r^2 = 2gs$.

Hence the velocity with which the ball strikes the ground is—

$r^2 = 2 \times 32 \times 6 = 4 \times 16 \times 6$

$r = 8\sqrt{6}$

It loses this velocity while describing $\frac{1}{120}$ of a foot,

$\therefore$ the time required for it is $\frac{1}{120} \div 4\sqrt{6} = \frac{1}{120} \div \frac{1128}{1000}$

$= .000425$ secs. Ans.

3. RUS.—'What their design may be' is a noun sentence subject to 'is unknown.' There is no difficulty. 'What' is an interrogative pronoun, neuter gen., nom. case, after the verb 'to be?'

4. HOPEFUL.—For English and Literature use 'Our Mother Tongue' (Hughes), and Stopford Brooke's 'Manual of English Literature,' 1s.; Macaulay's History, Green's 'Shorter History of the English People,' Chisholme's 'Commercial Geography,' and a modern Atlas, say Bartholomew's.

5. H. B.—You can most likely learn nearly all you want by study and reading. Get the Gifts, and read the lessons which have appeared in this journal, and then one or two of the recognised text-books on the subject. For information as to a certificate write to the Secretary, 181, High Street, Oxford Street, Manchester.

6. FREDERICK.—You have nothing to pay; you can take the journal and consider yourself at liberty to make all the use of it you can. Any bookseller will get the books which you name for you; the prices vary from 4s. 6d. to 2s. 6d.

7. M. ROSS (Invergordon).—You must be labouring under a mistake. The certificate referred to in this journal is the certificate awarded by the Education Department to those who pass the annual Government examinations. These certificates must be held by all who conduct elementary schools in England and Wales.

8. BRAY.—Nothing that we could say would be binding upon the department which will in due time announce its own decisions. In our opinion you need have little apprehension. Go on as if nothing had happened.

9. SYZYGY.—You don't say in what capacity you sat. The mark excellent usually carries a prize. How do you know that only one science counts? You would most likely get full credit for the best work you had done. You did not ask for any advice; perhaps you don't feel any need of it. We recommend you, however, to let science alone, and study English. Read good authors and practise English composition, and don't neglect penmanship.

10. M. JENTY.—The capital letters of the large hand and small hand are both bad. The other letters show promise, but are in many respects faulty. Get good copies and practise a few minutes every day. Large, 50; text, 55.

Replies to 'W. G.' (Applied Mechanics), are unavoidably held over this month, and will appear in our next issue.

Teachers and the New Code.

BY CHARLES BOWDEN.

Member of the Executive N.U.T.

THE PRACTICAL TEACHER is more or less used by every class of teachers throughout the country. The New Code affects every teacher at work in Elementary Schools. A succinct and collected account of the changes proposed by it will be of service to all our readers.

Seven classes of recognised teachers are specifically named in the Code:—(*a*) Candidates on probation, (*b*) pupil teachers, (*c*) assistant teachers, (*d*) provisionally certificated teachers, (*e*) certificated teachers, trained and untrained, (*f*) additional female teachers approved by the inspector, (*g*) evening school teachers.

(*a*) The only change with respect to candidates on probation is that English is not necessarily one of the class subjects in which they must pass before being admitted.

(*b*) The changes respecting pupil teachers are important. After two consecutive failures to pass the required examinations, which in the first, second and third years are the same as under the 1889 Code, a pupil teacher will no longer be recognised by the Department. The Department will examine the papers of a pupil teacher who is reported to have failed before the result is communicated to the managers.

The examination for fourth year pupil teachers is abolished, and the Queen's Scholarship examination is substituted. Each pupil teacher whose term of apprenticeship ends with the months July to November must sit at the examination in July of the year preceding the end of their engagement, while those whose term ends from December to June may sit, if they choose, at the examination in July following the termination of their engagements.

No provision seems to be made in the Memorandum of Agreement for continuing the services of the pupil teacher after the termination of his engagement to the date of the Scholarship examination if either party is disinclined to continue the services of the pupil teacher in school. The managers are, however, required to see that the pupil teacher is instructed up to that time, and the payment of £5 for a first class and £4 for a second class pass is dependent on the success of the pupil teacher at that examination. This is a defect in the Code which should be remedied. A pupil teacher will in future count on the staff for thirty children in average attendance, instead of forty as previously.

The passing of the Queen's Scholarship examination is in future to be the passport of pupil teachers who wish to become assistant teachers. No provision is made in the Code for the recognition of any ex-pupil teacher at present working in school as an assistant unless this condition has been complied with. Managers and teachers who employ several ex-pupil teachers may be fined for insufficient staff after 31st August next if their assistants do not sit at the Queen's Scholarship examination in July, 1890. There does not seem to be any provision for their being recognised even as pupil teachers till they have an opportunity of sitting at the examination. By the consent of the Department a pupil teacher who fails at the Scholarship may be retained an extra year as a pupil teacher. Failure to pass the examination on two occasions finally disqualifies a pupil teacher from employment in school. An assistant teacher will count on the staff for fifty instead of sixty as before.

Only those pupil teachers who pass in the first class of the Queen's Scholarship examination will in future be eligible as provisionally certificated teachers to take charge of small schools.

The changes respecting certificated teachers are numerous and important. After this year every candidate for a certificate must pass in both first and second year's papers and undergo probation of at least 18 months before any certificate is issued. There is in future to be but one class of certificate. Those candidates who pass in the first or second division of the second year's papers will be entitled to superintend pupil teachers. Those who fall into the third division will not have that right, and can only obtain it by re-examination, and that at intervals of two years from the previous examination.

There will be no endorsement of certificates. A certified copy of a school report may be obtained by the teacher on application to the managers. A trained certificated teacher is to count on the staff for 70, instead of 80, and an untrained only for 60. This is a distinction which will cause great annoyance. Provision for training has not been made for all the pupil teachers whom the government has allowed in schools. Many are thus untrained from no fault of their own. If they have attained the same position in the certificate list, there is no good reason for estimating them at a lower rate. Disabilities should not be placed upon them because of the faults of the Department. No one will deny that, as a rule, trained teachers are preferable to untrained, and are worth more. Facilities for training, however, should be given to all, and then the Department might make a difference. All teachers entitled to be recognised as certificated teachers under previous Codes will continue to be similarly recognised.

What then should be the course followed by those who have not the qualifications necessary for recognition in the various grades?

Our answer is: Pupil teachers must work harder in the future than in the past. They must always be in advance of the syllabus contained in the Code. They should regularly work test papers, such as those which periodically appear in the *Practical Teacher*. They should examine carefully the actual examination papers, which have been regularly printed in this magazine, and the model answers attached thereto. Those of the fourth year and those ex-pupil teachers who have not yet passed the Scholarship examination should study the kind of answers which have placed candidates at the head of the Scholarship in the past, to be found only in the back numbers of the *Practical Teacher*, and they should avail themselves of the facilities we afford for examination and correction of their periodical work.

Candidates for certificates, whether of the first or second year, cannot have a better syllabus of work than that provided by Dr. Beach. The doctor will prove a real and successful guide to all who have lost the advantages of the training college, and success will be assured to all who faithfully and earnestly follow his directions. The other general and specific articles we from time to time publish will aid materially in their preparation, and the query column is open for the solution of any difficulties which may from time to time arise.

The outcome of the Code will be the general raising of the qualifications necessary to employment in elementary schools.

—o—

Model Answers to Pupil Teacher Examination Papers.

19TH APRIL, 1890.

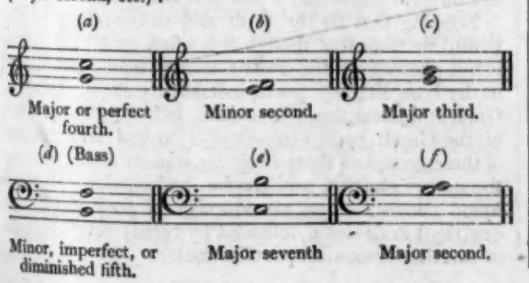
END OF FIRST YEAR.

Music.

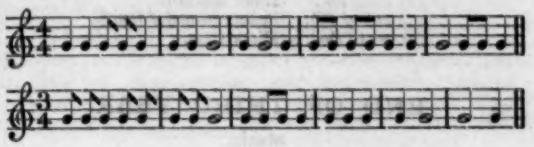
STAFF NOTATION.

1. Write the following an octave higher on the treble clef, halving the value of every note :—

2. Write below each of the following intervals its name (major second, etc.) :—



3. Add bars to the following in accordance with the time-signature :—

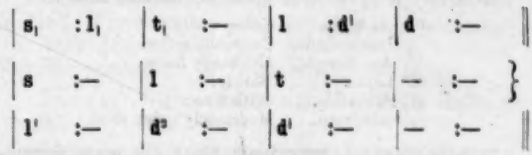


TONIC SOL-FA NOTATION.

1. State between which tones of the common scale there are (1) major thirds and (2) minor thirds.

(1) Between *doh* and *me*, *fah* and *lah*, *soh* and *te*.
(2) Between *ray* and *fah*, *me* and *soh*, *lah* and *doh*^{1}, and *te* and *ray*^{1}.

2. Write the following in two-pulse measure an octave higher, doubling the value of each note.



3. What are the three chief chords of the major scale? Write them in the order they are taught in the Tonic Sol-fa method.

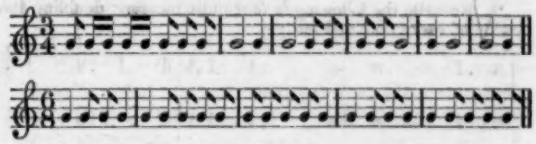
(1) *Doh* chord. (2) *Soh* chord. (3) *Fah* chord.

END OF SECOND YEAR.

Music.

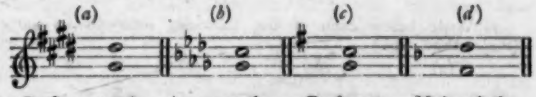
STAFF NOTATION.

1. Add bars to the following in accordance with the time-signature :—



2. Write the signatures of the following major keys :—

3. Write below each of the following intervals its name (major third, etc.) :—



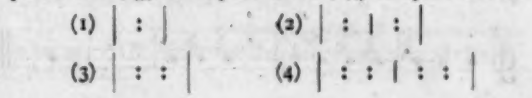
Perfect or major fifth. | Augmented or pluperfect fourth or tritone. | Perfect or major fourth | Major sixth.

TONIC SOL-FA NOTATION.

1. What is the mental effect (1) of *fah*, (2) of *me*, (3) of *t*$_1$, (4) of *soh*?

(1) Grave. (2) Calm. (3) Piercing. (4) Bright.

2. Write in primary form (1) a two-pulse measure (2) a four-pulse measure, (3) a three-pulse measure, (4) a six-pulse measure.



3. Write the names of the following intervals :—

(1) *fah* to *ray*^{1}. Major sixth.
(2) *te*$_1$ to *lah*. Minor seventh.
(3) *doh* to *fah*. Perfect or major fourth.
(4) *me* to *doh*^{1}. Minor sixth.

END OF THIRD YEAR.

Music.

STAFF NOTATION.

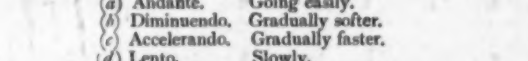
1. Complete each of the following bars by adding one note at the end :—

2. State (briefly) the meanings of thef ollowing terms :—

(*a*) Andante. Going easily.
(*b*) Diminuendo. Gradually softer.
(*c*) Accelerando. Gradually faster.
(*d*) Lento. Slowly.
(*e*) Sforzando. With force.
(*f*) Allegretto. Moderately quick time.

3. Write above (*a*) a major sixth, above (*b*) a minor seventh, above (*c*) a major third, and above (*d*) a perfect or major fifth.

(*a*) (*b*) (*c*) (*d*)



TONIC SOL-FA NOTATION.

1. Write a major sixth above each of the following notes :—

(1) Above *te*$_1$ = *se*. (2) Above *lah* = *fe*^{1}. (3) Above *me* = *de*^{1}. (4) Above *fah* = *ray*^{1}.

2. Re-write the following in four-pulse measure, doubling the value of every note and rest :—

| s .f :- .m | s . :t .l,t | d' .,l :s ||

| s :f |— :m | s : |t :l.t | d' :-.l | s :— ||

3. State (briefly) the meanings of the following terms :—

(1) Andante. Going easily.
(2) Diminuendo. Gradually softer.
(3) Accelerando. Gradually faster.
(4) Lento. Slowly.
(5) Sforzando. With force.
(6) Allegretto. Moderately quick time.

END OF FOURTH YEAR.

Music.

STAFF NOTATION.

1. Write below each of the following intervals its name (major third, etc.)

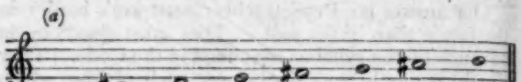
(*a*) (*b*) (*c*) (*d*)

Augmented fifth. Diminished seventh. Augmented second. Diminished or minor fourth.

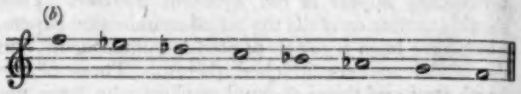
2. Re-write the following, halving the value of every note and rest :—

3. Add the necessary accidentals to (*a*), to form the scale of B minor with a minor sixth and a major seventh and to (*b*) to form the scale of F minor, with a minor seventh and a minor sixth :—

(*a*)



(*b*)



TONIC SOL-FA NOTATION.

1. Write the names of the following intervals :—

(1) *fah* to *se*. Augmented second.
(2) *ray* to *la*. Imperfect fifth.
(3) *me* to *le*. Augmented or pluperfect fourth or tritone.
(4) *se* to *doh*^{1}. Diminished fourth.

2. The tones *lah*$_1$ *te*$_1$ *se*$_1$ *lah*$_1$ are the relative minor for *doh ray te*$_1$ *doh* of the major key. Write under the following major phrase the equivalents in the minor.

d r f m	d s f m	l t$_1$ r d
l$_1$ t$_1$ r d	l$_1$ m r d	f se$_1$ t$_1$ l$_1$

3. Write (in figures) over each note and rest in the following passage its value in pulses or fractions of a pulse :—

1 ½ ¼ ¼ ¾ ¼ ½ ½ ⅓ ⅓ ⅓ ⅓ ½ 2

| m : .f,s | l .,s :d . | m.r .m : f.-.t$_1$ | d :— |

(To be continued.)

Short Studies in English Literature.

BY C. J. DAWSON, B.A.,

Ex-President of the N.U.T.

III.

MILTON'S HYMN ON THE MORNING OF CHRIST'S NATIVITY.

IN our study of Milton's magnificent ode or hymn on the Nativity we will assume that the student has more than once read the poem through carefully, and so obtained a fair general impression of its character. Let us bear in mind that though published with others of his early poems in 1645, it was written in 1629, when Milton was still a student at Cambridge, in his twenty-first year. The poet himself tells us in his sixth elegy, a Latin poem to his college friend Charles Diodate, that the idea of the hymn was conceived at dawn of Christmas Day in 1629. Enclosing with this elegy a copy of the ode, he says, 'It is a gift I have presented to Christ's natal day. On that very morning, at daybreak, it was first conceived.'

Looking first to the form and construction of the hymn, we note that though it is often called an ode it is not planned on the classic model made familiar to us by later English poets, notably by Pope, Dryden, Gray, and Coleridge, whose odes, following the pattern of the Greek poets, consist of a formal arrangement of three groups of three irregular stanzas each, bearing the names strophe, antistrophe, and epode. Milton's hymn consists of an introduction of four stanzas of one rhythmical form, followed by twenty-seven stanzas of another somewhat peculiar metre.

The earlier stanzas are based on the model adopted by Spenser, and hence known by his name. Each stanza consists of seven lines, the first five of which, both as to metre and rhyme, are like the corresponding lines of the Spenserian stanza, and these are followed by two other lines like the eighth and ninth of the Spenserian. In other words, Milton's stanza is like Spenser's, with the sixth and seventh lines omitted. The poet wrote two other poems in this metre, one of eleven stanzas, 'On the Death of a Fair Infant,' in 1626, and another, a fragment, On the Passion, in 1630.

The main part of the hymn is written in what Mr. Stopford Brooke describes as 'a vigorous, but somewhat jolting metre, which the felicity of its management and the curious felicity of the diction redeem from clumsiness.' In technical terms the stanza may be described as consisting of eight lines, of which the first, second, fourth and fifth are trimeters; the third and sixth, pentameters; the seventh, a tetrameter; and the eighth, a hexameter or Alexandrine. Some of the trimeters consist of five syllables only and require the first to be treated as a complete foot, for example, 'That the mighty Pan,' line 89; 'Must redeem our loss,' line 153; and 'Longer dare abide,' line 225. For the sake of rhythm the words 'ocean' (l.66), 'union' (l.108), and 'session' (l.164), require the old trisyllabic pronunciation, now practically obsolete.

The rhyming arrangement is that line one rhymes with line two, three with six, four with five, and seven with eight. It may be desirable to take note of the deviations from perfect rhyme which occur in the poem. The obvious instances are abode, trod (l.17—8), her, paramour (35—6), eyes, deformities (43—4), sphere, harbinger (48—9), stood, blood (56—7), appear, bear (83—4), voice, noise (96—7), lose, close (99—100), alone, union (107—8), quire, heir (115—6), vanity, die (136—7), infancy, glorify (151—4), session, throne (163—4), sweat, seat (195—6), fast, haste (211—2). Some of these are such as are commonly allowed, and, owing to the obstacles to perfect rhyming presented by the English tongue, are almost unavoidable. The question of perfection in rhyme is of course comparatively trifling. The student may recall the note with which Milton prefaced his greatest work, where he discards rhyme, or, as he more properly spells it '*rime*, as 'no necessary adjunct or true ornament of poem or good verse, but the invention of a barbarous age to set off wretched matter and lame metre.' The poet had doubtless experienced and duly appreciated the difficulties attending 'the troublesome and modern bondage of riming,' but in the poems of his earlier life he had been able to exercise himself with considerable ease within the limits of his self-imposed conditions.

Leaving now the consideration of the mechanical elements of versification, let us turn to notice the vocabulary of the poem. We submit a list of words we have marked as archaic, uncommon, or used with a peculiar meaning. The numbers refer to the lines.

Sages (5), wise men, here the Messianic prophets.

Deadly forfeit (6). *Forfeit*, from Lat. *foris*, out of doors, out of bounds, and *facere* to do, means literally misdeed; but it is here applied to the consequence or penalty of misdoing. Hence the expression means the penalty of death incurred by sin.

Wont (10), used. This is a participle form used for a past tense.

Trinal (11), from *tres*, three.

Squadrons (21), in its original use, squares of troops.

Wisards (23), wise men—the Magi. The termination *ard*, *art* is found in many old words, usually with a tone of depreciation, *e.g.*, *drunkard*, *laggard*, *sluggard*, *coward*, *dastard*, *braggart*, *sweetart*, now corrupted into *sweet-heart*.

Prevent (24), come before, from *pre*, *venio*, used as in the Collect, 'Prevent us, O Lord, in all our doings,' meaning anticipate, forestall, not, as now, 'hinder.'

Doffed (33), put off. *Doff* is an old word contracted from *do-off*, as *don* is from *do-on*.

Gaudy (33), from Latin *gaudium*, holiday, time of rejoicing, used in the sense of bright or ornamented.

Pollute (41), from Latin *polluere*, to defile, *pollutus*, defiled. Here, as in many other cases, Milton uses the verb derived from the Latin participle for the English participle. So *create* is used for *created*.

Cease (45). This is used transitively for 'cause to cease.'

Harbinger (49), from A.-S. *here*, an army; *beorgan*, to lodge or protect, one who prepares lodgment for an army, a forerunner. *Harbour* is similarly derived and means 'lodging for an army.'

Turtle wing (50), the wing of the turtle dove, symbolic of peace.

Strikes (52), produces as with the rod of enchantment. Compare, 'Then no planets strike' (Hamlet Act I. sc. 1).

Hooked (56), armed with hooks or blades like scythes attached to the wheels.

Awful (59), awestruck, not causing awe or dread, as in its later use.

Sovran (60), from Lat. *supra*, It. *sovrano*, corrupted into *sovereign* by transmission through French *souverain*.

Whist (64), hushed, a participle. Compare in Ariel's song in the Tempest I. 2, 'The wild waves whist.' The word is onomatopoetic, like *hush*, *hist*, and is hence applied to the card game which especially requires silence.

Amaze (69), amazement, wonder.

Pretious (71), from Lat. *pretium* price: the form *precious* is derived through the French, *précieux*.

Influence (71). Trench points out that down to recent times, poets always used this word with its old meaning of invisible mysterious power, believed to be exercised by the heavenly bodies. It is so used in *L'Allegro*. Compare, 'Canst thou bind the sweet influences of the Pleiades?' Job xxxviii, 31.

For all (73), means notwithstanding, or in spite of.

Orbs (75), used for 'orbits.'

Bespake (76). *Be* has here an emphatic or intensive force, spoke out.

As (81), for 'as if,' a common usage in old writers.

Or ere (86), before. Both words have the same meaning and origin. Compare, 'Or ever the silver cord be loosed.' (Eccles. xii. 6.)

Than (88), then. The two words were originally the same. The older form is here used for the sake of the rhyme.

Kindly (90). Here there is an evident trace of the primary meaning of the word *kind*, like one of themselves, *akin*.

Silly (92), innocent. This is used in almost the original sense, happy, from *saelig*, blessed, holy, happy.

Strook (95), for *struck*, accommodating the spelling to the rhyme.

Noise (97), music, of stringed instruments.

Took (98), charmed, captivated. Compare, 'No fairy takes' (*Hamlet* I. 1).

Close (100), cadence at the end of a strain of music. Compare, 'That music had a dying fall,' *Shakespeare*.

Thrilling (103), from A.-S. *thirlian*, to pierce. *Drill*, *trill*, and *nostril* are from the same root.

Shame-faced (111), corrupted from *shame-fast*, not connected with *face*.

Unexpressive (116), inexpressible, used in the same sense in *Lycidas* 176, and in *As You like It*, III. 2, 'The fair, the chaste, the unexpressive she.'

Weltering (124), rolling round, from A.-S. *waltan*, to roll, German *walzen*, whence *waltz*. *Wallow* is from the same root.

Consort (132), from Lat. *consors*, sharing the same lot, hence agreement.

Speckled (136), spotted. This may have a two-fold reference to the varied adornment of the vain, and the specks or spots outward signs of disease.

Sheen (145), brightness, noun from *shine*.

Redeem our loss (153), may mean redeem or save us who are lost, or redeem, recover for us what we have lost.

Ychained. Past participle formed on the analogy of A.-S. verbs, the *y* representing the prefix *ge*. A few such participles are used in modern English poetry, as *yclept*, *yclad*. The peculiarity in this word is that the obsolete participial sign is used with a French root, *chaine*, from Latin *catena*.

Aghast (160), terrified as at a *ghost*.

Swindges (172), for swings, whirls about.

Parting (186), for departing. Compare 'parting day' (Gray's Elegy), 'Speed the parting guest.'

Genius (186), guardian spirit of the place, plural *genii*.

Flower-inwoven (187), interwoven with flowers. The line expresses a sign of mourning, tresses braided with flowers, but torn and dishevelled.

Lars and *Lemures* (192), spirits of the departed, good and bad. Ghosts and goblins.

Flamens (194), priests. *Flamen* contracted from *filamen*, the wearer of a *fillet*.

Quaint (194), strange, curious, from old Fr. *coint*, Lat. *cognitus*, known, familiar, pleasing. A later meaning is delicate. Compare this with *uncouth*, unknown, explained in a former paper, and shown to have an offensive meaning.

Forgoes (196), goes without. The prefix *for* is here used privatively.

Shine (202), noun used for *sheen*, brightness.

Unshowered (215). This word is used in allusion to the lack of rain in Egypt.

Dusky eyn (223), eyes made dim with excessive light. *Eyn* is the old plural, still used in Scotland in the form *een*.

Youngest teemed (240), last produced, from A.-S. *tyman*, to beget.

Bright-harnest (244), clad in bright armour. Compare *Macbeth* V. 5: 'At least we'll die with harness on our backs.' Also 1 Kings xxii., 34.

As in our study of *L'Allegro* and *Il Penseroso*, we would call attention to Milton's felicitous use of compound and other epithets. The student will not perhaps find this earlier poem equally rich in this respect, but he will do well to note the following: *Far-beaming* blaze; *Darksome* house of *mortal* clay; *Star-led* wisards; *Heaven-born* child; *guilty* front with *innocent* snow; *Saintly* veil of *maiden* white; *Meek-eyed* Peace; *Turtle* wing; *Amorous* clouds; *Charmed* wave; *Fretious* influence; *Burning* axle-tree; *Divinely warbled* voice; *Shame-faced* night; *Helmed* cherubim; *Sworded* seraphim; *Well-balanced* world; *Weltering* waves; *Crystal* spheres; *Angelic* symphony; *Celestial* sheen; *Radiant* feet; *Tissued* clouds; *Pale eyed* priest; *Prophetic* cell; *Haunted* spring; *Flower-inwoven* tresses; *Twilight* shade; *Tangled* thickets; A *drear* and *dying* sound; *Twice-battered* god of Palestine; *Grisly* king; *Timbrelled* anthems; *Sable-stoled* sorcerers; *Yellow-skirted* fays; *Moon-loved* maze; *Bright-harnest* angels.

The instances of 'apt alliteration' are very numerous, and add much to the flowing melody of the poem. Their frequency may, however, help to strengthen that feeling to which more than one eminent critic has given expression, that the hymn abounds too much in conceits and elaborate ornamentation. The figurative character of the diction is so remarkable, that to quote and classify the metaphors, similes and other figures of speech would be to write and re-write almost every line. Instead of following this course, we will simply suggest it as an exercise for the student, and proceed to direct attention to one or two questions with regard to the subject matter of the composition.

First, remembering that the central idea is a cardinal incident in the foundation of the Christian religion, we must be prepared to find frequent references to the Christian Scriptures. In the introduction and the early part of the hymn the circumstances of the birth of Christ, as related by the Evangelists, are dealt with in a highly poetical fashion. Thus we have references to the offerings of the wise men, the singing of the angel quire, the rude manger. In the language or the thought we observe also several distinct references to passages of Scripture. For example, line 28:—

> 'From out his secret altar touched with hallowed fire.'

is suggestive of the passage in Isaiah vi., 6, 7: 'Then flew one of the seraphims unto me, having a live coal in his hand, which he had taken with the tongs from off the altar; and he laid it upon my mouth, and said, Lo, this hath touched thy lips; and thine iniquity is taken away, and thy sin purged.' The twelfth stanza of the hymn is a beautiful paraphrase of the passage in Job xxxviii., including the verse 'When the morning stars sang together, and all the sons of God shouted for joy.' The latter part of stanza 17 is founded on 1 Thessalonians iv., 17, and the next stanza on the Revelation. Line 183, 'A voice of weeping heard and loud lament,' finds its original in Isaiah lxv., 19, or in Jeremiah xxxi., 15. The 'twice battered god of Palestine' is the Dagon of the fifth chapter of the First Book of Samuel. These are only a few of the Biblical references that Milton's hymn suggests to the student.

While, however, the Scriptural basis of the poem is so thoroughly kept in view, nothing is more remarkable about this work than the abundance of allusions to the classical mythology, and the pagan polytheism of Egypt and other nations of antiquity. One of these allusions, where the shepherds are represented as seated chatting about their loves or their sheep, and not thinking that their Lord was coming to live amongst them, is of a daring kind, because Christ is spoken of as 'the mighty Pan.' Pan was the god of shepherds, and it may be noted that in the *Shepherd's Calendar*, Spenser, in a similar imitation of a Scriptural passage, speaks of our Lord as Pan.

Among the heathen deities mentioned are *Peor* and *Baalim*, gods of Phœnicians and Canaanites, referred to in Numbers xxv., 3; *Dagon*, the fish-god of the Philistines; *Ashtaroth*, the Hebrew name for Astarte, the Greek Aphrodite, or Venus, goddess of love; the *Libyc Hammon*, or Ammon, the chief Egyptian deity; *Thammuz*, the Greek Adonis; *Moloch*, the idol of brass to whom the Hebrews sacrificed their children, hence the type of a cruel deity; the Egyptian gods, *Orus*, *Isis*, *Osiris*, *Anubis*, *Typhon*. Of these, Osiris, represented by Milton as the ox-god trampling the grass, was the god of the Nile. Isis was his wife; Orus, god of the sun, and Anubis, the dog, were his sons, and Typhon his brother. The ox-god, according to the mythology, was Apis, whom Milton does not name.

There are many allusions to the Greek mythology, but these are in very different terms from those in which the 'brutish gods of Nile,' and the Phœnician deities are described. Notice the exquisite stanzas 19 and 20, in which the oracles cease to give counsel, Apollo leaves the steep of Delphos, and the guardian spirits of the mountains, springs, and woods depart with sighs and lamentations. These two stanzas have been said to be the finest in the poem. But Walter Savage Landor preferred the four stanzas beginning 'No war, or battle's sound.' Of these, which describe the peaceful state of the world when Christ was born, Landor says, 'It is incomparably the noblest piece of lyric poetry in any modern language that I am conversant with.'

The result of such study as we have endeavoured to assist should enable the reader to form sound opinions on the scope and inner meaning of the great lyric poem under consideration. At the same time it may be helpful and encouraging for every student to know what some of the most eminent scholars and critics have thought of this hymn. With two or three quotations, therefore, we venture to conclude this paper.

'The Hymn on the Nativity,' says Dr. Garnett, 'begins with two stanzas of far fetched prettiness, and goes on ringing and thundering through strophes of ever increasing grandeur, until the sweetness of Virgin and Child seem in danger of being swallowed up in the glory of Christianity, when suddenly, by an exquisite turn, the poet sinks back into his original key, and finally harmonizes his strain by the divine repose of a concluding picture worthy of Correggio:—

> "But see the Virgin blest
> Hath laid the Babe to rest," etc.

Dr. Garnett adds, however, that 'Milton's treatment of the Olympian deities jars upon us who remember his obligations to them. If the most Hebrew of modern poets, he still owed more to Greece than to Palestine.'

Mr. Mark Pattison was less lavish in his praise of this poem. 'The Ode,' he says, comparing it with *L'Allegro* and *Il Penseroso*, 'notwithstanding its foretaste of Milton's grandeur, abounds in frigid conceits, from which the two later pieces are free. The Ode is frosty, written in winter, within the four walls of a college chamber. The two idylls breathe the free air of spring and summer, and of the fields round Horton.'

As a final extract we cannot do better than place before the reader for his help and guidance the following brief but eloquent summary given by Mr. Stopford Brooke: 'The argument is very simple. At the child's birth the world was at peace, and peaceful all nature. In the hush of the universe the shepherds hear the angel song, and heaven bursts into singing, which, were it to last, the golden age were come. But so it cannot be, and in sharp contrast Milton paints the judgment-day. Not till after that will be our full bliss, but in Christ's birth that coming glory is begun. The old dragon and his brood are shorn of their power; all the pagan gods and oracles mourn and fly away, and the Virgin lays her Babe to rest. Peace begins and peace ends this splendid song, and between the goals of peace, in finely contrasted music, the sacred beauty of the Christian heaven and the solemn unity of God is set over against the "dismal horror" and polytheism of the pagan worship. Yet he is kind to the Greeks: his love of classic beauty seized him as he wrote the nineteenth and twentieth stanzas; and the touch of mediævalism when the ghosts and the yellow-skirted fays slip away from the morn completes this strange Renaissance mingling of Christianity, classicism, and the middle ages.'

(To be continued.)

—o—

Certificate Examination, 1889.

Female Candidates.

FIRST YEAR.

Mental Arithmetic.

(TWENTY *minutes allowed for this Paper.*)

You are to enter the answer in the space (——) left for it after each question. Nothing is to be written on this paper except the particulars required, and the answers (which must be written in ink only) to the questions. *No erasures or alterations are permitted.* They will be marked as errors.

1. Add together all the numbers from 1 to 20 inclusive (——).

$$\text{Sum} = (1 + 20) \times \tfrac{20}{2}$$
$$= 21 \times 10$$
$$= \underline{210}. \text{ Ans.}$$

2. Find the interest on £400 invested in Two-and-a-Half per Cent. Stock at 95 (——).

$$\text{Interest} = \frac{2\frac{1}{2}}{95} \text{ of } £400$$
$$= 1\tfrac{1}{38} \text{ of } £400$$
$$= £200 + 19$$
$$= \underline{£10\ 10\text{s. } 6\tfrac{6}{19}\text{d.}} \text{ Ans.}$$

3. Divide £150 between A and B in the ratio of 21 : 9 (——).

$$\text{A's share} = \frac{21}{21 + 9} \text{ of } £150$$
$$= \tfrac{21}{30} \text{ of } £150$$
$$= \underline{£105}. \text{ Ans.}$$

$$\text{B's share} = £5 \times 9 = \underline{£45}. \text{ Ans.}$$

4. What will $4\frac{1}{2}$d. per week amount to in a year and a half? (——).

Amount = $4\frac{1}{2}$d. × 78

$= \left(\frac{39}{78} \times \frac{3}{4}\right)$s.

$= 11\frac{7}{8}$s.

= £1 9s. 3d. Ans.

Or, 78 times 4d. = 26s.

78 ,, $\frac{1}{2}$d. = 39d. = 3s. 3d.

Total = £1 9s. 3d. Ans.

5. How many times will a hoop, $3\frac{1}{2}$ yards in circumference, turn in going 14 miles? (——).

No. = 14 × 1760 ÷ $3\frac{1}{2}$

= 1760 × 4

= 7,040. Ans.

6. Find the number of half-pints in 11 gallons (——).

No. = 11 × 16

= 176. Ans.

7. How many yards of carpet, 2 feet wide, will be needed to cover a floor measuring 22 feet by 20 feet? (——).

No. = (22 × 20 ÷ 2) ÷ 3

= 220 ÷ 3

= $73\frac{1}{3}$. Ans.

8. Add together $\frac{3}{4}$ of a sovereign, $\frac{1}{16}$ of half a crown, and $\frac{7}{16}$ of a florin (——).

Sum = 17s. 6d. + 2d. + $\frac{3}{8}$s.

= 17s. 8d. + $4\frac{1}{2}$d.

= 18s. $0\frac{1}{2}$d. Ans.

9. If I buy an article for 9d. and sell it for 11d., what do I gain per cent.? (——).

Gain per cent. = $\frac{11\text{d.} - 9\text{d.}}{9\text{d.}} \times 100$

= $\frac{2}{9}$ of 100

= $22\frac{2}{9}$. Ans.

10. How many children will a school-room, 76 feet by 22 feet, accommodate, allowing 8 square feet per scholar? (——).

No. = 76 × 22 ÷ 8

= 19 × 11

= 209. Ans.

11. Express as decimals of £1, the following sums:—6s. 6d.; £6 4s.; £1 17s. 6d. (——).

6s. 6d. = 6·5s. = £·325. Ans.

£6 4s. = £6$\frac{1}{5}$ = £6·2. Ans.

£1 17s. 6d. = £1$\frac{7}{8}$ = £1·875. Ans.

12. Fine the fourth term of 108 : 24 :: 27 : ( ) (——).

Fourth term = $\frac{24 \times 27}{108}$

= 6. Ans.

13. Find the cost of 83 articles at 1s. $11\frac{1}{2}$d. each (——).

Cost = (83 × 2)s. − 83 hf. d.

= £8 6s. − 3s. $5\frac{1}{2}$d.

= £8 2s. $6\frac{1}{2}$d. Ans.

14. Add the square of 19 to the square of 23 (——).

Sum = 361 + 529

= 890. Ans.

$19^2 = (19 + 1)(19 - 1) + 1^2$

$= (20 \times 18) + 1$

= 361;

$23^2 = (23 + 3)(23 - 3) + 3^2$

$= (26 \times 20) + 9$

= 529.

ALTERNATIVE PAPER.

1. Add together the squares of 3, 4, 5, and 6 (——).

Sum = 9 + 16 + 25 + 36

= 86. Ans.

2. Find the interest on £400 at 5 per cent. for 7 months (——).

Interest = $\frac{7}{12}$ of £20

= £35 ÷ 3

= £11 13s. 4d. Ans.

3. What will $3\frac{1}{2}$d. a week amount to in a year? (——).

Amount = (3d. × 52) + ($\frac{1}{2}$d. × 52)

= 13s. + 2s. 2d.

= 15s. 2d. Ans.

4. How many coins worth $2\frac{1}{4}$d. each could be obtained for £4 10s.? (——).

No. = 90 × 48 ÷ 9

= 480. Ans.

5. How many yards of carpet half a yard wide will be needed to cover a floor measuring 24 feet by 18? (——).

No. = $\frac{24 \times 18}{9} \times 2$

= 24 × 4

= 96. Ans.

6. At a reduction of 25 per cent. for ready money what must I pay for three dozen books published at 9d. each? (——).

Amount = $\frac{3}{4}$ of 9d. × 36

= 9d. × 27

= ($\frac{3}{4}$ of 27)s.

= $\frac{81}{4}$s.

= £1 0s. 3d. Ans.

7. Find the second term of 80 : ( ) :: 72 : 54 (——).

Second term = $\frac{80 \times 54}{72}$

= 60. Ans.

8. Add the square of 27 to the square of 72 (——).

$27^2 = (27 + 3)(27 - 3) + 3^2$

$= (30 \times 24) + 9$

= 729;

$72^2 = (72 + 2)(72 - 2) + 2^2$

$= (74 \times 70) + 4$

= 5,184;

Sum = 729 + 5,184

= 5,913. Ans.

9. Multiply 7,832 by 25; and 688 by 99 (——).

Product = 7,832 × 25

= 7,832 × $\frac{100}{4}$

= 195,800. Ans.

Product = 688 × 99

= 688 × (100 − 1)

= 68,800 − 688

= 68,112. Ans.

10. Add together $\frac{3}{5}$ of £1, £1·35, $\frac{7}{12}$ of half-a-crown, and ·3 of a shilling (——).

Sum = 12s. 6d. + £1 7s. + (2$\frac{1}{2}$d. × 7) + $\frac{3}{10}$s.

= £1 19s. 6d. + 1s. $5\frac{1}{2}$d. + 4d.

= £2 1s. $3\frac{1}{2}$d. Ans.

11. Express as decimals of £1 the following sums of money, 18s., £2 5s., and 15s. 6d. (——).

18s. = £$\frac{18}{20}$ = £·9. Ans.

£2 5s. = £2$\frac{1}{4}$ = £2·25. Ans.

15s. 6d. = 15.5s. = £·775. Ans.

12. Add together a third, a fourth, and a fifth, and a sixth (——).

$\frac{1}{3} + \frac{1}{6} = \frac{1}{2}$; $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$;

Sum = $\frac{3}{4} + \frac{1}{5}$

= $\frac{15 + 4}{20}$

= $\frac{19}{20}$. Ans.

13. What is the average height of four persons whose heights are 5 feet, 5 feet 6 inches, 5 feet 9 inches, and 5 feet 1 inch? (——).

Average height = (5ft. + 5ft. 6in. + 5ft. 9in. + 5ft. 1in.) ÷ 4

= 5ft. + {(6 + 9 + 1) in. ÷ 4}

= 5ft. 4in. Ans.

14. Divide £180 between A and B in the ratio of 33 to 12 (——).

A's share = $\frac{33}{33 + 12}$ of £180

= $\frac{11}{15}$ of £180

= £132. Ans.

B's share = £4 × 12

= £48. Ans.

Female Candidates.

FIRST YEAR.

Arithmetic.

(TWO *hours and a* HALF *allowed for this Paper.*)

[No candidate is permitted to answer more than TEN questions. The *solution* must be given at such length as to be intelligible to the examiner, otherwise the answer will be considered of no value.]

1. Divide seven hundred and fifty thousand five hundred and seven by 132. Work by factors and explain how you obtain your remainder.

$$132 \left\{ \begin{array}{l} 12 \overline{)750,507} \\ 11 \overline{)62,542 + 3} \\ \quad 5,685 + 7 \end{array} \right\} 87$$

The quotient is 5,685 and remainder 87.

The remainder is obtained thus :—After dividing by 12 there are 3 units over.

After dividing the twelves by 11 there are 7 twelves over or 84 units, and these added to the 3 units give a total remainder of 87.

2. Reduce ·38636 to a vulgar fraction. Show how you would explain the process to a class, using ·18 as an example.

$$\begin{aligned} &\cdot38\dot{6}3\dot{6} \\ &= \cdot3\dot{8}6\dot{3} \\ &= \frac{3863 - 38}{9900} \\ &= \frac{\overset{1}{\cancel{3825}}}{\underset{4}{\cancel{9900}}} \\ &= \frac{\overset{1}{\cancel{153}}}{\underset{4}{\cancel{396}}} \\ &= \underline{\frac{17}{44}}. \text{ Ans.} \end{aligned}$$

The decimal ·18 equals ·1 followed by an infinite series of eights.

$$\left.\begin{array}{l} \text{Let } x = \cdot1\dot{8} \\ \text{Then } 100x = 18\cdot\dot{8} \\ \text{And } \quad 10x = \quad 1\cdot\dot{8} \end{array}\right\}$$

Subtracting] $90x = 17$

$$\therefore \underline{x = \tfrac{17}{90}}. \text{ Ans.}$$

We thus see the rule : Subtract the non-recurring figures from the whole decimal for the numerator (18 − 1 = 17), and for the denominator place a nine for every recurring figure followed by a cypher for every non-recurring figure (90 in this case).

3. A school with 78 boys and 72 girls on the books meets 432 times. If each boy loses one meeting in 9, and each girl one in 8, find

(1) the average attendance of each sex,
(2) the total number of attendances made by the whole school.

(1) Average attendance of the boys $= \frac{8}{9}$ of $\overset{26}{\cancel{78}}$

$$\begin{aligned} &= \underset{3}{\cancel{24}} \\ &= 69\tfrac{1}{3}; \end{aligned}$$

" " " girls $= \frac{7}{8}$ of 72

$$= \underline{63}.$$

(2) Total number of attendances

$$\begin{aligned} &= (\tfrac{8}{9} \text{ of } 432 \times 78) + (\tfrac{7}{8} \text{ of } 432 \times 72) \\ &= (384 \times 78) + (378 \times 72) \\ &= 29,952 + 27,216 \\ &= \underline{57,168}. \text{ Ans.} \end{aligned}$$

4. By what fraction of a ton is $(\frac{1}{7} + \frac{5}{112})$ of a cwt. greater than $\frac{1}{4}$ of $\frac{1}{3}$ of a qr.?

$$\text{Fraction} = \frac{(\frac{1}{7} + \frac{5}{112}) \text{ cwt.} - (\frac{1}{4} \text{ of } \frac{1}{3}) \text{ qr.}}{1 \text{ ton}}$$

$$\begin{aligned} &= \frac{\frac{60 + 63}{140} - \frac{1}{4} \text{ of } \frac{1}{9} \text{ of } \frac{1}{2}}{20} \\ &= (\tfrac{123}{140} - \tfrac{1}{12}) \times \tfrac{1}{20} \\ &= \frac{1107 - 50}{1260} \times \tfrac{1}{20} \\ &= \frac{\overset{151}{\cancel{1057}}}{\underset{180}{\cancel{12600}}} \times \tfrac{1}{20} \\ &= \underline{\tfrac{151}{3600}}. \text{ Ans.} \end{aligned}$$

5. A publican, having bought a barrel (36 gals.) of beer at eighteenpence a gallon, less a discount of 2s., retails $\frac{2}{3}$ of it at 4d. a pint, and then fills up $\frac{1}{8}$ of the vacant space with water, and sells the mixture at the same price. How much per cent. does he gain on the barrel?

$$\begin{aligned} \text{Cost price} &= 1\tfrac{1}{2}\text{s.} \times 36 - 2\text{s.} \\ &= 52\text{s.}; \end{aligned}$$

$$\text{Quantity of water added} = \frac{2}{3} \text{ of } \frac{1}{8} \text{ of } \overset{3}{\cancel{36}} \text{ gals.}$$

$$\begin{aligned} &= 3 \text{ gals.}, \\ \text{Selling price} &= 4\text{d.} \times 39 \times 8 \\ &= 13\text{s.} \times 8 \\ &= 104\text{s.}; \\ \text{Gain} &= 104\text{s.} - 52\text{s.} \\ &= 52\text{s.}; \end{aligned}$$

$$\therefore \underline{\text{Gain} = 100 \text{ per cent.}} \text{ Ans.}$$

6. If a sixpenny loaf weigh 4·35 lbs. when wheat is at 5·75s. a bushel, what should be paid for 98·6 lbs. of bread if wheat were 9·2s. per bushel?

$$\left.\begin{array}{ccc} \text{lbs.} & \text{lbs.} & \\ 4\cdot35 & : & 98\cdot6 \\ \text{s.} & & \text{s.} \\ 5\cdot75 & : & 9\cdot2 \end{array}\right\} :: 6\text{d.} : \text{cost.}$$

$$= \frac{\overset{68}{\cancel{9868}} \times \overset{4}{\cancel{920}}}{\underset{1}{\cancel{435}} \times \underset{5}{\cancel{575}} \times \underset{2}{\cancel{2}}} \text{s.}$$

$$\begin{aligned} &= \tfrac{272}{15}\text{s.} \\ &= \underline{18\text{s. } 1\tfrac{1}{5}\text{d.}} \text{ Ans.} \end{aligned}$$

7. Explain why certain vulgar fractions cannot be expressed accurately as decimals. How can you tell such fractions by simple inspection? Give examples.

Divide 2·52 by ·0072.

If a terminating decimal be converted into a vulgar fraction the denominator will be 10 or some power of 10.

The factors of 10 are 2 and 5.

Therefore, when the fraction is in its lowest terms, if the denominator be not composed solely of the factors 2 and 5, or one of them, or of powers of 2 and 5, or one of them, then the division of the numerator by the denominator will never terminate.

Examples :—

$$\left.\begin{array}{l} \frac{1}{6} = \frac{5}{2 \times 3} \\ \frac{7}{15} = \frac{7}{5 \times 3} \\ \frac{19}{56} = \frac{19}{8 \times 7} = \frac{19}{2^3 \times 7} \end{array}\right\} \text{These vulgar fractions will not terminate.}$$

$$\begin{array}{r} \cdot0072)2\cdot5200(350. \text{ Ans.} \\ 216 \\ \hline 360 \\ 360 \\ \hline \end{array}$$

8. A roof, measuring 18 feet along the ridge, and 10 ft. 8 in. from ridge to eaves, has to be covered with slates 16 inches long and 8 broad, each slate overlapping the one below it by 2 inches. Find the cost of the slates at 16d. a dozen.

$$\begin{aligned} \text{Number of slates from ridge to eaves} &= \frac{10 \text{ ft. } 8 \text{ in.} - 2 \text{ in.}}{16 \text{ in.} - 2 \text{ in.}} \\ &= \tfrac{128}{14} \\ &= 9; \end{aligned}$$

$$\begin{aligned} \text{Number of slates along the roof} &= 18 \text{ ft.} \div 8 \text{ in.} \\ &= \frac{\overset{9}{\cancel{18}}}{1} \times \frac{3}{\underset{1}{\cancel{2}}} \\ &= 27; \end{aligned}$$

$$\text{Total number of slates required} = \frac{\overset{3}{\cancel{9}} \times 27 \times \underset{1}{\cancel{2}}}{\underset{4}{\cancel{12}}} \text{ dozen}$$

$$\begin{aligned} &= 40\tfrac{1}{2} \text{ dozen}; \end{aligned}$$

$$\therefore \text{Cost} = 16\text{d.} \times 40\tfrac{1}{2}$$

$$= \frac{\overset{2}{\cancel{4}} \quad \overset{27}{\cancel{81}}}{\underset{3}{\cancel{12}} \times \cancel{2}}$$

$$= 54\text{s.}$$

$$= \underline{\pounds 2\ 14\text{s.}} \text{ Ans.}$$

9. Three partners gain £3,650: the first advances one-third of the capital for one-fourth of the time; the second, one-fourth of the capital for one-half of the time; and the third, the remainder of the capital for the whole time. Find their respective shares of the profit.

$$\text{Proportions} = \tfrac{1}{3} \times \tfrac{1}{4}, \tfrac{1}{4} \times \tfrac{1}{2}, \text{ and } \{1 - (\tfrac{1}{3} + \tfrac{1}{4})\}$$

$$= \tfrac{1}{12}, \tfrac{1}{8}, \text{ and } \tfrac{5}{12}$$

$$= \frac{2,\ 3,\ 10}{24};$$

$$\therefore \text{Share of first} = \frac{2}{2+3+10} \text{ of } \pounds 3{,}650$$

$$= 1\tfrac{3}{15} \text{ of } \pounds 3{,}650$$

$$= \pounds 486\ 13\text{s. } 4\text{d.};$$

$$\text{,, second} = 1\tfrac{3}{15} \text{ or } \tfrac{1}{5} \text{ of } \pounds 3{,}650$$

$$= \pounds 730;$$

$$\text{,, third} = \tfrac{10}{15} \text{ or } \tfrac{2}{3} \text{ of } \pounds 3{,}650$$

$$= \underline{\pounds 2{,}433\ 6\text{s. } 8\text{d.}} \text{ Ans.}$$

10. By selling 8 tons of tea at 1s. 6½d. per lb. a merchant loses 7½ per cent. At what price should he sell it to gain 10 per cent.?

£ (100 − 7½) : s. d. 1 6½ :: £ (100 + 20) : selling price per lb. in second case.

£ s. d. £

92½ : 1 6½ :: 120 : selling price per lb.

2 12 22

185 18

5 2

37

$$= 22\text{d.}$$

$$= \underline{1\text{s. } 10\text{d. per lb.}} \text{ Ans.}$$

11. A boat, with 2,720 sq. ft. of sails spread, travels 51 knots in 8½ hours when the wind gives a pressure of ·125 lbs. per sq. foot. How far will it go in 2½ hours with a sail area of 7,650 sq. ft. and a wind pressure of ·5 lbs. per sq. ft., assuming the speed to be proportioned to the area of the sail and the wind-pressure?

sq. ft. sq. ft.

2,720 : 7,650

hrs. hrs. } knots

8½ : 2½ } :: 51 : Distance.

lb. lb.

·125 : ·5

272 : 765 } knots

51 : 15 } :: 51 : Distance.

1 : 4

$$= \frac{\overset{45}{\cancel{765}} \times \cancel{15} \times 4 \times 51}{\underset{17}{\cancel{272}} \times \cancel{51}} \text{ knots}$$

$$= \underline{180 \text{ knots.}} \text{ Ans.}$$

12. How would you make children understand the mistake committed in the following—

$$\tfrac{1}{3} + \tfrac{1}{4} \text{ of } \tfrac{1}{3} - \tfrac{1}{8} = \frac{8+3}{12} \times \frac{20-9}{24}$$

$$= 1\tfrac{1}{2} \times 1\tfrac{1}{2} = 1\tfrac{11}{24}?$$

Simplify—

$$\frac{\frac{1}{3} - \frac{1}{4}}{5 - \frac{1}{6} \text{ of } 1\frac{1}{5}} \div \frac{\frac{1}{2} \text{ of } \frac{7}{10\frac{1}{2}}}{1\frac{1}{3} + \frac{1}{2}}$$

(1) Fractions connected by 'of' must be multiplied together before any other operation, as they represent a compound fraction.

If brackets are not given, they should be imagined before and after the signs plus and minus.

$$\therefore \tfrac{1}{3} + \tfrac{1}{4} \text{ of } \tfrac{1}{3} - \tfrac{1}{8}$$

$$= \tfrac{1}{3} + \tfrac{1}{12} - \tfrac{1}{8}$$

$$= \frac{16 + 5 - 9}{24}$$

$$= \tfrac{12}{24}$$

$$= \underline{\tfrac{1}{2}} \text{ Ans.}$$

(2) $$\frac{\frac{1}{3} - \frac{1}{4}}{5 - \frac{5}{6} \text{ of } \frac{117}{130}} \div \frac{\frac{1}{2} \text{ of } \frac{7}{10\frac{1}{2}}}{1\frac{1}{3} + \frac{1}{2}}$$

$$= \frac{40 - 35}{56} \div \frac{\frac{1}{2} \text{ of } \frac{2}{3}}{25 + 3}$$

$$= \frac{5}{56} \div \frac{1}{15}$$

$$= \frac{5}{56} \times \frac{20}{93} \times \frac{\overset{2}{\cancel{186}}}{21} \times \frac{28}{\underset{3}{\cancel{15}}}$$

$$= \underline{\tfrac{10}{9}} \text{ Ans.}$$

13. At what rate per cent. simple interest will £4317 10s. amount to £5,019 1s. 10½d. in 4 years 4 months?

$$\text{Interest} = \pounds 5{,}019\ 1\text{s. } 10\tfrac{1}{2}\text{d.} - \pounds 4{,}317\ 10\text{s.}$$

$$= \pounds 701\ 11\text{s. } 10\tfrac{1}{2}\text{d.};$$

$$\text{Interest for one year} = \pounds 701\ 11\text{s. } 10\tfrac{1}{2}\text{d.} \div 4\tfrac{1}{3}$$

$$= \pounds 701\ 11\text{s. } 10\tfrac{1}{2}\text{d.} \times \tfrac{3}{13}$$

$$= \pounds 2{,}104\ 15\text{s. } 7\tfrac{1}{2}\text{d.} \div 13$$

$$= \pounds 161\ 18\text{s. } 1\tfrac{1}{2}\text{d.};$$

£ s. £ £ s.

$\therefore$ 4,317 10 : 100 :: 161 18½ : Rate %.

20 20

86350 3238

8 8

690800 25905

4 15

$$= \underline{3\tfrac{3}{4} \text{ per cent.}} \text{ Ans.}$$

14. In the thermometer of Fahrenheit, freezing point is 32°, and boiling point is 212°. In the Centigrade thermometer the freezing point is 0°, and the interval between freezing and boiling point is divided into a hundred degrees. Find what is the equivalent on the Centigrade scale, of 54° Fahrenheit, and what is the equivalent on the Fahrenheit thermometer of 72° Centigrade.

(1) $$\text{Centigrade scale} = (54^\circ - 32^\circ) \times \frac{100^\circ}{212^\circ - 32^\circ}$$

$$= 22^\circ \times \frac{\overset{5}{\cancel{100}}}{\underset{9}{\cancel{180}}}$$

$$= \frac{110^\circ}{9}$$

$$= \underline{12\tfrac{2}{9}^\circ}. \text{ Ans.}$$

(2) $$\text{Fahrenheit scale} = \left(72^\circ \times \frac{\overset{9}{\cancel{180}}}{\underset{5}{\cancel{100}}}\right) + 32$$

$$= \frac{648^\circ}{5} + 32^\circ$$

$$= 129\tfrac{3}{5}^\circ + 32^\circ$$

$$= \underline{161\tfrac{3}{5}^\circ}. \text{ Ans.}$$

(To be continued.)

Publications Reviewed.

Royal School Series: The Royal Atlas Readers. Nos. I. to V. London: Thomas Nelson and Sons.

No more charming introduction to a knowledge of the rudiments of geography do we remember ever to have read, than that which is provided in the earlier books of this new series of geographical reading books. The form adopted in the books for standards I. and II. is a series of lessons forming consecutive chapters in a narrative not too closely connected but yet fairly continuous from the beginning to the end of the volume. In this way the facts and principles are presented in so pleasant a guise that the young reader will become impressed with them almost unawares. Thus the first notions of a plan come through a present of tame rabbits to a little boy, involving the erection of a rabbit hutch, for which a plan is required and speedily devised. Many everyday incidents in the little boy's life are made use of to extend this idea of a plan to a cottage, a school, a village, a town, and thus is evolved the idea of a map. Ideas of scale and direction are developed in the same interesting fashion. The language of the lessons is simple and well within the grasp of the children for whom the book is intended.

In the second book the interest is connected with three cousins, who live respectively in a city, in the country, and at the seaside. Their visits to each other, their letters, and other incidents are made the means of introducing all sorts of knowledge about rivers, hills, the sea and land. Stories of shipwreck, of lifeboat rescues, and of lighthouses are introduced, and the narrative is relieved by short poems of a simple and cheerful character. At the end of each lesson is a statement of the facts to be remembered. One of these statements at the close of a very pretty story about the tide, contains a serious mistake, which anyone using the book should take care to correct at once, as we doubt not the publisher will do in further issues. The summary runs, 'The tide is the rising and the falling of the ocean once in twenty-four hours. The water rises or flows up the beach for twelve hours, and then falls or ebbs for twelve hours.' This occurs on page 100 and is repeated on page 130.

The volumes for the higher standards are admirable specimens of the ordinary type of geographical readers. The facts of a text-book being presented in well-constructed reading lessons, made attractive by a pleasing style, good type, and abundant illustrations. Lists of new words and explanatory notes are given at the end of each lesson.

Each book of the series claims to be a reader and text-book in one, and this claim is justified by the latter part of each volume consisting of a tolerably full summary of the geography of the standard, with numerous maps neatly and clearly printed.

The Royal Atlas Readers have many merits, and we can cordially recommend them to teachers in search of a good series of school-books: but we are aware that the enterprise of publishers has made the task of selection a rather embarrassing one.

Standard Teaching Helps. Standard IV. By H. MAJOR, B.A. London: A. G. Dawson.

Everything we have said in praise of the former volumes of these Teaching Helps applies with equal, if not greater, force to this volume. The hand of a practical teacher is visible on every page, and although teachers adopt different methods, no young teacher would fail to become skilled in his work if he followed the letter and the spirit of the methods adopted in this book. Where a teacher retains a class for a whole year, a master could hardly do better than place in his hand this volume, and see that he works up to it, and intelligent progress of the class would be the result. We heartily commend the book.

Guide to the Scholarship Examination. By Benson Clough. London: George Gill and Sons.

This volume, the third edition of a useful and popular compilation, has been considerably enlarged by means of an appendix, and brought completely up to date.

The book takes a senior pupil-teacher by the hand, ably directs his studies, gives him full particulars about the Scholarship Examination and its questions, and furnishes him with ample information respecting the various Training Colleges, with perhaps the exception of Caernarvon and Saltley.

Much discrimination and toil have been wisely directed to produce the sound advice given, the logical arrangement adopted, and the accuracy attained.

Homer, however, sometimes nods, and we venture to question the utility of inserting the table given on p. 48. Such an amount of work per diem is utterly impossible for average pupil-teachers. We do not think that more than three hours daily can by them be profitably spent in study.

With some hesitation we doubt the wisdom of making one's own 'Historical Note Book.' In the days of inferior compilations this advice was undoubtedly prudent, but now, marginal and interlinear manuscript annotations will suffice for so ordinary a subject as 'Scholarship' history.

Would it not improve a work of this kind (which requires annual 'posting-up') if at the end of each division a few blank pages were inserted, whereon newly-given questions could be transcribed or pasted?

A passage on p. 89 somewhat puzzles us: 'A good mathematician is almost certain of a First Class, because they are so few.'

Again, we notice in the excellently rendered translations that a word or two is occasionally slipped, *e.g.*, '*quasi*' and '*aliquandoque*,' on p. 182 (translation on p. 241), and *en été* on p. 189 (translation on p. 246).

Nevertheless these are but infinitesimal sunspots, and Mr. Clough may be congratulated on a thoroughly sound, accurate and useful 'Guide,' one that is indeed almost essential for success.

Vere Foster's Drawing Books. London: Blackie & Son.

Messrs. Blackie are issuing a new edition of this popular series of drawing books. As is well known, the series embraces every description of drawing, and consists of about sixty books. We have received ten of the new series, five of them being the earlier numbers, suitable for nearly all the standards in schools. The books are well graded, obsolete copies have been removed and new ones introduced, the paper is very suitable, and the new copies are examples of a familiar and pleasing kind. The books of animals and figures are such as boys love to draw, and are sure to give satisfaction. General and particular directions are printed on the covers, and in its new form the series is sure to become increasingly useful and popular.

Notes on Shakespeare's Play of King Richard II. By T. Duff Barnett, B.A. London: George Bell and Sons.

Another of the admirable series of note-books by Mr. Barnett, on selected plays of Shakespeare. The introduction sets forth the purpose of this particular play, and includes a careful analysis of the character of the weak king, Richard, who is compared with Hamlet, and contrasted with Bolingbroke. The etymological and explanatory notes are of the most valuable kind, and their general accuracy is vouched for by the statement that that high authority on philology, Professor Skeat's Dictionary, has been invariably referred to for verification. There is the same thorough classification of the abundant information as we have commended in former volumes of the series. The student who adopts this book as companion for a good text of the play, will lack nothing necessary to an intelligent study of the subject.

Pickwick Papers in Phonography. By Charles Dickens. London: Isaac Pitman and Sons.

All students of Shorthand will be glad to have the opportunity of renewing their acquaintance with the bright and pleasant reading of Charles Dickens in Phonography. The two volumes now before us are clearly printed in easy reporting style, and are produced in a handy and elegant form. To those who desire to become proficient in Phonography, reading practice is most essential. One of its many advantages is to familiarise the student with the host of contracted words and phraseographic combinations ordinarily employed in writing and reporting.

To those of our readers who have studied this system, we can warmly recommend Mr. Pitman's latest addition to the Phonographic Library.

Chemistry (Elementary Text Book). London: Blackie & Son.

This is a small manual of 48 pages, intended for beginners. The syllabus of the code for children in elementary schools is quoted. The author tells us he has taught the subject on the lines thus laid down to large numbers of children between the ages of nine and nineteen, and the book before us is an expansion of the notes of lessons he has prepared for his work. Teachers will find the book clearly written, well illustrated, and beautifully printed. It is both good and cheap.

Bacon's Excelsior Memory Map Atlas. London: G. W. Bacon & Co.

This is a book of sixty-two memory maps and diagrams arranged alphabetically. Nothing fuller or better for preparation for examination map drawing could be desired. We cannot give the book higher praise than this.

OUR CERTIFICATE CLASS.

Replies to Correspondents received too late for insertion on page 111:—

BEDA (Southampton).—You are not at present qualified to teach drawing.

S. K. (Redditch).—Provisional Certificates are not issued to teachers more than 25 years of age.

P. R. (Knaresborough).—Apply to the colonial agent.

CUI BONO.—Of no use, but you may address the Secretary, Education Department, Whitehall, London.

M. S. C. (Leeds); A. T. (Saltley College); W. L. (Deakford, Cullen, N.B.); F. W. (Walton, Ipswich), answered per ordinary letter.

We have the pleasure to state that the Prize in connection with the Competition announced in our last issue has been awarded to Mr. John Finnemore, Bealings Schools, Woodbridge, Suffolk. The words have been set to music by Mr. R. Dunstan, Mus. Bac., and appear on page 134.

If Miss Ada Cross and Miss Annie Jackson will kindly furnish the Editor with their full addresses, the corrected Examination Papers will be returned forthwith.

The Review which appeared in our last issue, entitled 'Science of *Common* Life,' should have been printed 'The Science of Everyday Life' (Cassell and Co.).

We understand that a new series of French and German Handbooks will shortly be published by Mr. Joseph Hughes, of Pilgrim-street, Ludgate-hill. The volumes will be edited by Mr. J. J. Beuzemaker, B.A., Examiner in Modern Languages to the College of Preceptors.

Owing to the great pressure on our space we are compelled to hold over until next issue, 'How a Scotch School was Examined,' as well as a large number of Reviews.

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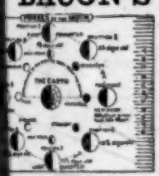

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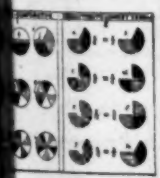

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